

ANNUAL NARRATIVE REPORT
CALENDAR YEAR 1987

MISSISQUOI
NATIONAL WILDLIFE REFUGE

NATIONAL WILDLIFE REFUGE SYSTEM
FISH AND WILDLIFE SERVICE
U.S. DEPARTMENT OF THE INTERIOR



REVIEW AND APPROVALS

MISSISQUOI NATIONAL WILDLIFE REFUGE
Swanton, Vermont

ANNUAL NARRATIVE REPORT

Calendar Year 1987

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Wildlife Resources
Regional Office Approval

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UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

The Missisquoi National Wildlife Refuge includes most of the Missisquoi Delta where it enters Missisquoi Bay which is part of Lake Champlain. The refuge is situated in the northwest corner of Vermont. The refuge boundary is within a few hundred yards of the Canadian border.

The total refuge area consists of 5,839 acres. Habitat types are diverse. Cover types break down approximately as follows: woodland swamp, 1,619 acres; shrub swamp, 3,580 acres; hayfields and old fields undergoing succession, 520 acres; and about 108 acres of commercial forests. Administration lands for roads, buildings, etc. take up about 12 acres.

The floodplain and marshes of the Missisquoi Delta provide a major resting and feeding area for migrating waterfowl. Waterfowl production is also an important activity. Nest-boxes supplement natural cavities for wood ducks, common goldeneyes and hooded mergansers. Nesting habitats for black ducks and other ground-nesting waterfowl is limited by the usually high water during the spring.

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A. HIGHLIGHTS

- Transect Surveys of Cranberry Pool
- The refuge participated with State of Vermont in State "Take Pride" Steering Committee
- The first "Partnerships in Education" scholarships were awarded at the local high school as a spin-off from the Refuge's earlier involvement in this initiative
- The refuge sponsored three Honorable Mention winners in the National Hunting and Fishing Day Poster Contest for the seventh consecutive year
- Additional observation stations were used for brood surveys
- Some needed habitat and dike maintenance was accomplished with improved equipment

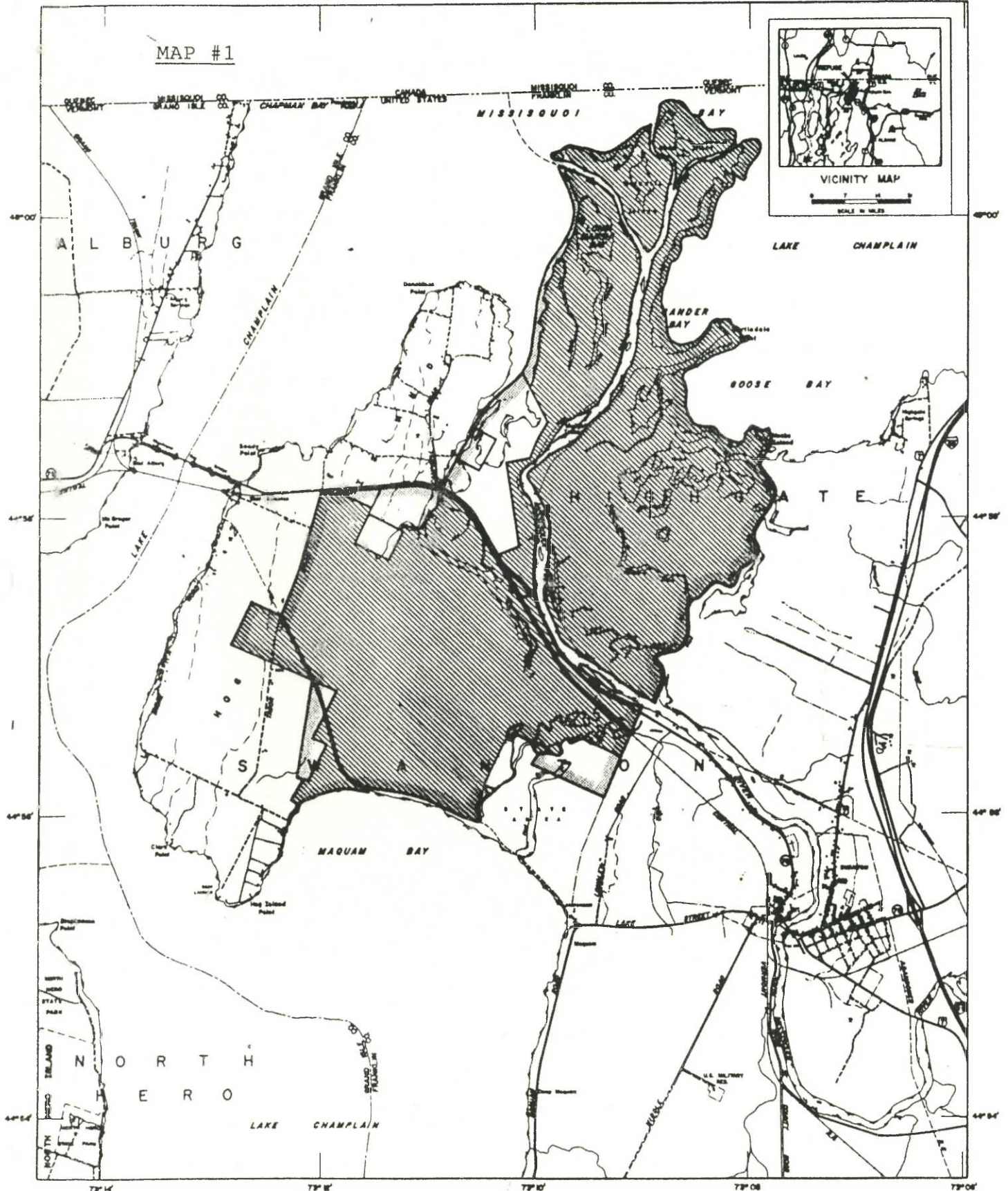
GENERAL OPERATING MAP

MISSISQUOI NATIONAL WILDLIFE REFUGE

FRANKLIN COUNTY, VERMONT

UNITED STATES
DEPARTMENT OF THE INTERIOR

UNITED STATES
FISH AND WILDLIFE SERVICE



COMPILED IN THE BRANCH OF ENGINEERING FROM
SURVEYS AND AERIAL PHOTOGRAPHS OF 1938
BY U.S. AND F.W.S.

BOSTON, MASSACHUSETTS
REV. 801118

FEBRUARY, 1966

Scale 0 1 2 3 4 5 6 7 8 9 10 MILES

MEAN
DECLINATION
1965

B. CLIMATIC CONDITIONS

The past year provided a variety of unique climatic features. The annual high temperature of 90 degrees F. on August 18, was higher than that for 1985 and 1986. While the annual low temperature of -29 degrees F. (without the wind chill factor) on February 14 - 15, was only exceeded during the past ten years, by 1983 (-30 degrees F.), and 1981 (-40 degrees F.). Further information is shown in Table 1.

Total precipitation at the refuge headquarters measured 23.67" of rain and 50" of snow. Both precipitation figures are well below the 1977 - 1986 ten-year average of 58.26" of snow, and 34.29" of rain. April experienced a low rainfall total, as did 1986, with only 1.91". June turned out to be the month with the most rainfall, with 3.37". The heaviest single rainfall was 2.36", during November 27-28, while the single heaviest rainfall occurred on January 21.

The 1987 temperatures were generally similar to those of past years. The "severity index" on Table 1, provides an average temperature for 1987 that is 1.7 degrees F. higher than that of 1986, and only 0.2 degrees F. higher than that of 1985. This year was better for agricultural crop production than 1986.

Ice-out on the Missisquoi River started on March 25. A brief ice-jam occurred in the usual shallow area of the river opposite the headquarters on March 26, but cleared on the same day without flooding the surrounding vicinity. By April 1, the Missisquoi River and Dead Creek were open for boat use. However, the Lake Champlain and lakeshore areas were not free of ice until later.



Ice-out was uneventful this year. JBG

Freeze-up of the Missisquoi River and Dead Creek began on November 21, however, intermittent warm weather delayed complete freeze-up until mid-December. Lake Champlain was ice-locked by the end of November, however.

The lack of significant "April showers" permitted refuge staff to draw down the Cranberry Pool water level to the objective (97.20' mean sea level (MSL)) by May 14.

Lake Champlain, Missisquoi River and Dead Creek water levels influence much of the refuge's wetlands habitats during most of the year. Readings for the Cranberry Pool, Missisquoi River and Lake Champlain are routinely obtained throughout most of the year, to provide refuge staff with better information for managing water levels. Section F.2. deals with this topic in greater detail.

During 1987, the Lake Champlain high water level peaked at (a conservative) 99.36' MSL, during April 9 - 15. This resulted in a below-average period of flooding during the spring ice-melt. Peak flood levels in the past have often exceeded 100' MSL, resulting in a longer, sustained period of flooding in refuge wetlands. The annual Lake Champlain peak low level was 94.49' MSL, slightly lower than normal. Additional information on water levels of the Missisquoi River, Dead Creek system and Lake Champlain is in Section F.2. of this narrative, including comparisons.

TABLE #1 - 1987 CLIMATIC CONDITIONS

MONTH	TEMPERATURE (oF.)			PRECIPITATION (in.)		
	Peak	Peak	Monthly	Rain	Snow	
	High	Low	Averages			
JANUARY	39	-23	15.0	----	26	
FEBRUARY	38	-29	9.4	----	8	
MARCH	67	-9	28.4	0.58	4	
APRIL	79	20	48.7	1.91	---	
MAY	87	25	54.4	2.55	---	
JUNE	84	44	62.2	3.37	---	
JULY	89	42	68.5	3.15	---	
AUGUST	90	40	64.2	2.59	---	
SEPTEMBER	76	36	58.9	3.16	---	
OCTOBER	66	22	44.7	2.19	---	
NOVEMBER	65	5	39.3	3.28	2	
DECEMBER	47	-4	26.8	0.89	10	
ANNUAL SEVERITY INDEX			43.4	23.67	50	
			ANNUAL TOTALS			

C. LAND ACQUISITION

1. Fee Title

No land acquisition occurred in 1987. The total refuge acreage remains at 5,839 acres.

We might have had an opportunity to acquire about nine acres along Route 78, but the owner sold the property to a local resident before there was any opportunity for the Service to make an offer. In this particular instance, the landowner initially had decided to sell the property at auction. The Nature Conservancy had been alerted and was prepared to have someone bid at the auction. At the eleventh hour, the owner sold it to a local resident just before the auction was to start.

D. PLANNING

2. Management Plan

Missisquoi N.W.R. was scheduled to prepare the following in F.Y. 87: a Sign Plan; a Part I Background Chapter for the Station Management Plan; and a Marsh and Water Management Plan.

A Water Management Plan had been completed and submitted in F.Y. 86, so we were ahead on that one. The Sign Plan was not undertaken, pending receipt of a revised Sign Manual. The Part I Background information was rough-drafted, but not submitted until the fall of 1987.

Since revising our Sign Plan was in abeyance, a current Sport Fishing Plan was prepared and submitted.

5. Research and Investigations

Missisquoi NR-84-02, "Inventory of Invertebrate Species of the Missisquoi Delta." (53520-02)

Specimen collection was undertaken in 1987. No progress report has been received at this time.

Missisquoi NR-84-04, "Factors Affecting Growth and Distribution of Pitch Pine on Bog Soils."

No final report has been received as of the beginning of 1988.

Though not a formal study, a survey of aquatic vegetation on three transects in the Cranberry Pool was carried out by refuge staff. This was done at the suggestion of Jon Anderson, a State Fisheries Biologist, during discussion of possible mitigation measures if the dike is ever extended.

Still around?
see of pond
for FWL

6. Other Planning

The refuge manager participated in a task group formed by the State of Vermont to review and revise the State's Comprehensive Outdoor Recreation Plan (SCORP). The new Plan is simply called the Vermont Outdoor Recreation Plan. The State approached the writing of the Plan differently in 1987. The Plan was developed by various task groups representing various natural features or recreation groups. The manager served on a State and Federal Agencies task group which reviewed the recommendations that came out of many of the other task groups.

E. ADMINISTRATION

1. Personnel



Manager, Assistant Manager, Tractor Operator,
Outdoor Recreation Planner and Secretary RAZ

1

2

5

3

4

PERSONNEL

1. Robert A. Zelley.....Refuge Manager, GS 11...EOD 09/02/84, PFT.
2. John B. Gallegos.....Assistant Refuge Manager, GS 9.....EOD 05/14/84, PFT.
3. Juanita I. Blaskowski.....Outdoor Recreation Planner, GS 7.....EOD 06/77.....Converted from Secretary.....11/10/85, PFT.
4. Sheila S. Bluto.....Secretary, GS 5.....EOD 02/16/86, PFT.
5. Daniel R. Johnson.....Tractor Operator, WG 6/3.....EOD 07/26/82 TPT.....converted to PFT 07/06/86.

TABLE #2 - REFUGE STAFFING FYs 83 - 87

Number of Employees

YEAR	PERMANENT		TEMPORARY	TOTAL FTEs
	Full-time	Part-time		
FY 87	5	0	0	5.00
FY 86	5	1	3	5.43
FY 85	2	1	3	4.17
FY 84	2	1	1	3.37
FY 83	2	1	1	3.63

3. Other Manpower Programs

Three persons were employed under special job training programs during the year. Jim Bruyette and Gayle Fitzgerald were employed under a job training program sponsored by the State of Vermont, Department of Employment and Training. Ms. Fitzgerald was dropped from the program after a few weeks. Mr. Bruyette was a very reliable worker through the spring and summer. General facility and ground maintenance tasks were carried out.

Mr. Rick Barratt was also employed at the refuge in maintenance of trails and buildings, boundary posting and banding. His work was funded by the Abenaki Self-Help Association. His employment was terminated in October as we approached our less-busy winter period.



Rick Barratt

6. Volunteer Programs

The woodworking class of Missisquoi Valley Union High School (MVU) helped the refuge again this year by constructing 12 new wood duck boxes under the guidance of their instructor, Mr. Neal Sheehan. The refuge provided the hemlock, hardware and building specifications. Hemlock was not a good choice of wood, as it split during construction and fractured during drying.



**Wood duck nest boxes made by students at
Missisquoi Valley Union High School (MVU)**

JBG

Under the guidance of Neal Sheehan, eighth-grade woodworking students at MVU constructed 12 blue-bird houses to be erected on the refuge. Norbert Blaskowski and son, Dawson (our youngest volunteer at age two and one-half years), put up the 12 houses in the fields adjoining the refuge.

As a result of a volunteer recruitment advertisement in the St. Albans Daily Messenger, on February 11, two men contacted the refuge to donate services. Don Hulbert, one of the volunteers repaired 12 nest boxes.

Volunteer Cecile Beauregard helped Outdoor Recreation Planner (ORP) Juanita Blaskowski widen a section of the nature trail along Maquam Creek.

On September 12, 11 young volunteers participated in a Federal Lands Day cleanup project along the Missisquoi River at Mac's Bend. The crew removed several 55-gallon garbage bags of trash. When their work was completed, they joined the youth waterfowlers for a hearty lunch.



Volunteers picked up several bags of litter
along the Missisquoi River NGB

On September 26, at our National Hunting and Fishing Day celebration, Manager Zelley presented Certificates of Appreciation to four of our faithful volunteers: Julien Beauregard, for his donation of artwork for refuge brochures; Alan "Tiny" Brown, for his many years of retriever demonstrations at the Youth Waterfowl Training Program; Todd Sudal, for donating time and ingredients for his "Gourmet" luncheon, consisting of pickled rabbit, fish chowder, venison and moose jerky and moose meatballs at the annual National Hunting and Fishing Day celebration; and Randy Savage, for being the official weight and measurement man at the fishing derbies.



Julien Beauregard receives Certificate of Appreciation for his donations of artworks for refuge leaflets. JIB

Volunteers helped refuge staff with breeding pair surveys conducted May 1-9.

During the month of June, volunteers assisted refuge staff with brood surveys. This year's survey was the most extensive and accurate to date, with 11 tree stands manned, and all units well-surveyed.

Volunteers helped band 649 ducks during preseason waterfowl banding effort.

5. Funding

Funding for Fiscal Years 1984 through 1988 is tabulated below.

TABLE #3 MISSISQUOI N.W.R.

Funding FYs 84 - 88

:	"	"	"	"	"	"	:
:	ITEMS	FY 84	FY 85	FY 86	FY 87	FY 88	:
:	"	"	"	"	"	"	:
:	Operations	"	"	\$89,900	\$143,526	\$154,365	:
:	"	"	"	"	"	"	:
:	Resource	"	"	"	"	"	:
:	Problems	"	"	\$15,000	\$ 1,000	\$ 14,000	:
:	"	"	"	"	"	"	:
:	ARMMs	"	"	\$49,000	\$ 25,000	\$ 45,500	:
:	"	"	"	"	"	"	:
:	TOTALS	\$178,000	\$137,000	\$153,900	\$169,526	\$213,865	:

6. Safety

Safety Committee meetings were held monthly. Staff members took turns holding the meetings. No lost time occurred due to accidents in 1987.

The following safety-related actions were taken in 1987: blade guards were reinstalled on both table saws. Warnings were painted on fuel tanks and pumps. "Eye and/or ear protection required," signs were posted near appropriate equipment. Four station personnel were provided baseline hearing tests. Defensive Driving instruction was obtained through the Postal Service.



Steel pipes and warning signs were installed
as part of overall Safety Program. JBG

7. Technical Assistance

Refuge staff provided some technical assistance to Mr. Lawrence LaFrance in the design and locating of wood duck nest boxes on nearby privately-owned land. Mr. LaFrance reported that he had about 50% use of the boxes.

8. Other Administrative

Refuge revenue sharing checks in the amounts of \$1,676 and \$1,257 were delivered to the Towns of Swanton and Highgate respectively.

A handicapped accessibility survey was completed in December.

F. HABITAT MANAGEMENT

1. General

Missisquoi NWR's 5,839 acres are comprised of the following habitat types:

5,199 Acres	-	Palustrine wetlands
265 Acres	-	Croplands
178 Acres	-	Grasslands
108 Acres	-	Woodlands
77 Acres	-	Brushlands
12 Acres	-	Buildings, Roads, Parking Lots, etc.

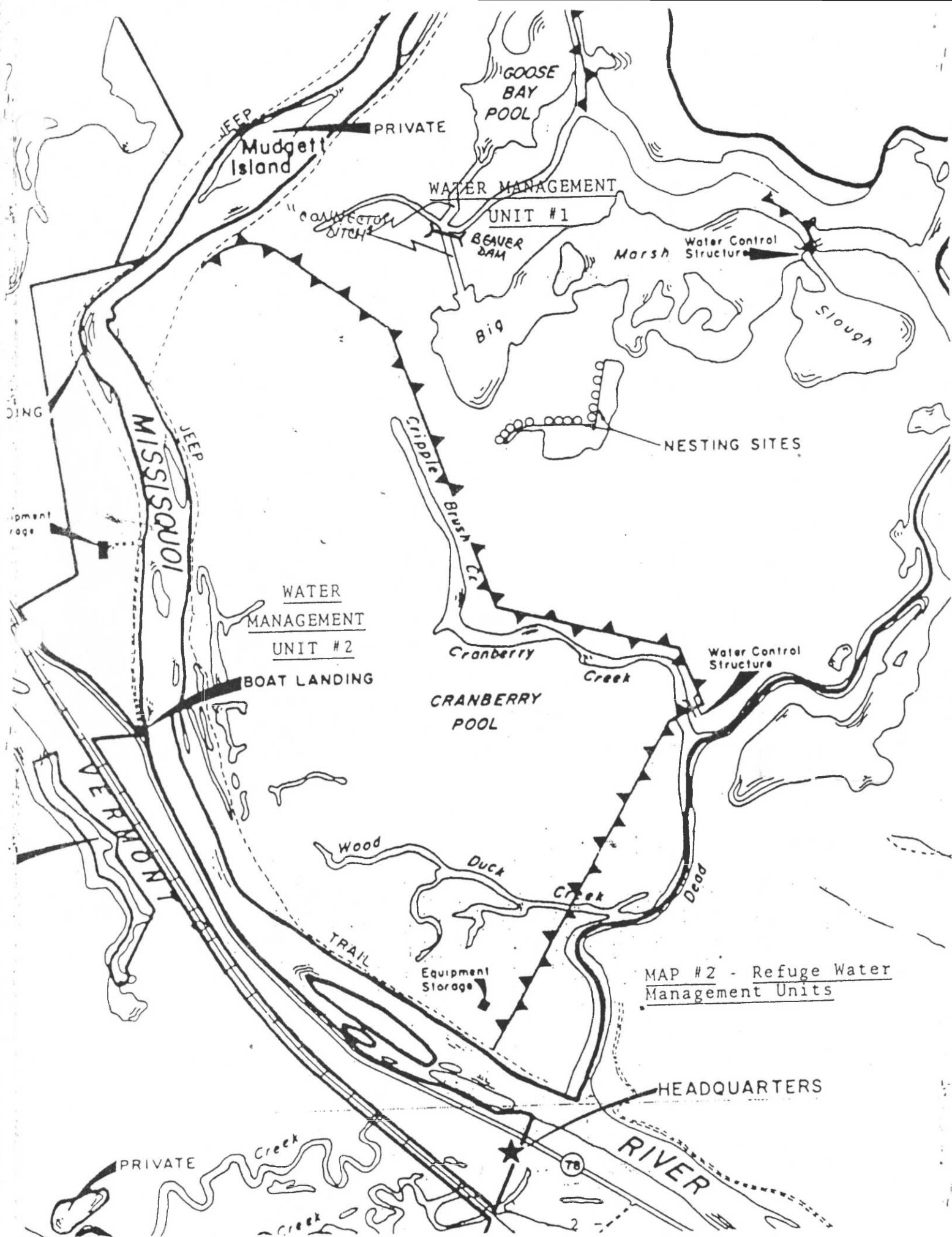
Special emphasis is placed upon management of swamp and marsh habitats in this refuge because of their values to waterfowl during the breeding, molting and migration seasons. Management of other natural habitats has been limited to haying and prescribed burning during the past three years.

Temporary posting is done on a seasonal basis along the refuge lakeshore properties, where our ownership extends well beyond the water's edge to the 93.055' mean sea level (MSL) ground elevation. This posting program starts in late June or early July, when public use increases. It is designed to keep the public from intruding into refuge closed areas, where significant production and brood rearing is still occurring. This is also

where waterfowl concentrations of unpaired, and/or juvenile females and males and postbreeding adults gather. In addition, the temporary posting defines specific hunting areas for the fall waterfowl hunting public. Subsiding water levels, at this time of the year, also make it easier to take measurements of bottom elevations and place the "in-water" posts and signs, without having water over-top our waders. (Leeches prevent refuge staff from using only shorts and sneakers in many areas with mucky bottoms.) Temporary posting consists of 2" x 3" x 10' rough-cut hemlock posts with the proper signing bolted on. During the last week or two of the hunting season in December, when the ice is forming, refuge staff retrieve signs for re-use during the following year, thereby saving the cost of replacing them. The spring ice breakup will take these signs out, if ice-shifting prior to March has not already done so.

2. Wetlands

Wetlands on Missisquoi NWR include three incompletely diked impoundments (Cranberry Pool, Goose Bay Pool and Big Marsh Slough) that total approximately 1,200 acres, adjacent to 400-500 acres of unimproved marshes more directly influenced by the water levels of Lake Champlain (Ref. Map #2). Of the three "impoundments," only Cranberry Pool is successful at maintaining water levels at the desired 97.20' MSL level during the late summer when lake levels are lowest.



Goose Bay Pool comprises an estimated 100 acres of open water bordered with shrub swamp, while Big Marsh Slough is made up of 600 acres of open water and shrub swamp. These two "impoundments" are intended ultimately to become one water management unit (WMU), if the diking is completed. Two "gut plugs" form this unit. One - an 800' dike - closes the drainage in Big Marsh Slough, and the other - a 2,000 dike - separates Goose Bay Pool from Goose Bay proper. Lake levels control the water levels in this area until the perimeter elevation of approximately 96.50' MSL is reached. A 4' corrugated metal pipe (CMP) outlet, equipped with stop-logs, is located in the Big Marsh Slough Dike. However, it is not functional and currently serves no purpose. Costly maintenance and upgrading are required upon it and the adjacent dike before it can be made serviceable.

Submergent and floating plants predominating within the Goose Bay Pool - Big Marsh Slough area are coontail, water-weed and water lilies. Within the connecting ditches between the two areas are also found two pondweeds: floating-leaf (Potamogeton natans) and ribbon-leaf (P. ephihydrus). emergent plants include wild rice, bur-reeds, pickerelweed and arrowheads. Buttonbush ("Cripplebrush" in this area) is the principal woody plant.

Water levels along the Missisquoi Delta and Lake Champlain shore during the spring (April - May) high-water period averaged 97.89' MSL, lower than the 1986 average (98.52' MSL), but higher than the high-water averages for 1984 (96.68' MSL) and 1985 (97.61' MSL). The peak high-water level during 1987 was only 99.36' MSL (4/9 - 4/15), lower than the peaks of 1986 (100.36' MSL) and 1984 (99.66' MSL), but higher than 1985 (98.16' MSL). Peak high-water levels are usually maintained for only a few days, after which levels subside. The 1987 water levels provided for another excellent production year for the wild rice on the refuge, as well as for arrowheads, wild celery, bur-reeds, wild celery and hardstem bulrush. Eurasian milfoil was also predominant along the lake-shores of

Campbell's Bay - Charcoal Creek (north), Gander Bay and Goose Bay, where the bottoms are shallow and mucky.

The more open-water areas of the Goose Bay Pool - Big Marsh Slough WMU are heavily utilized by waterfowl during migration. Use is lighter during the summer, when groups of post-breeding ducks and duck broods inhabit this unit.

Scattered buttonbush stands within the WMU are utilized as cover by duck broods and molting ducks, at this time. Waterfowl use during the winter freeze is nonexistent. The peak waterfowl use period is normally during mid-September through October, when thousands of ring-necked ducks settle in to feed and molt, together with hundreds of mallards, and lesser numbers of black ducks and green-winged teal from Canada. Arrowhead tubers and wild rice are two of the principal duck foods in this area.

The principal water sources to the Goose Bay Pool - Big Marsh Slough WMU are precipitation, Dead Creek and Lake Champlain.

The second impounded area, or WMU is the Cranberry Pool. This Pool includes 500 - 550 acres of open water, shrub swamp and some wooded swamp immediately east of the Missisquoi River. Unlike the Goose Bay Pool - Big Marsh Slough Unit, control over water levels therein is present, until the Missisquoi River exceeds the 99.25' MSL, at which point water may enter Cranberry Pool via a low riverbank west of the Goose Pen Channel area. Some water control is possible, despite the fact that nearly 8,400' of diking remains to be completed because of the low riverbank along most of the adjacent section of the Missisquoi River. Two 4' CMP water control structures (WCS) located just west of Dead Creek permit the desired draw-down of the Pool (Ref. Map #3) once lake levels drop below 99.25' MSL.

Submergent plant composition is similar to the Goose Bay Pool - Big Marsh Slough Unit, with pondweeds, coontail, water lilies and

waterweed predominating. Emergents consist of beds of wild rice along the dikes and scattered throughout the impoundment, pickerelweed in the open pools of the interior, burreed and arrowheads that thrive in the dead timber zone along the pool perimeters. Rice cutgrass and broad-leaf water plaitain (Alisma plantago-aquatica) are also found on higher ground in the dead timber zones. Woody vegetation in Cranberry Pool is predominantly buttonbush.

Water levels within the Cranberry Pool WMU were first recorded at 97.99' MSL (3/30) during "ice-out" on the Missisquoi River and Dead Creek. The Missisquoi River peaked during this same period, as it carried meltwaters from further up-river. The first reading (99.76' MSL) of the Missisquoi River was taken on 4/1. Waters from the river entered the Cranberry Pool at those areas where the riverbank is lowest. Flooding of this WMU continued from late March until on or about 4/15, when river levels dropped below 99.25' MSL - the lowest undiked elevations along the western side of Cranberry Pool.

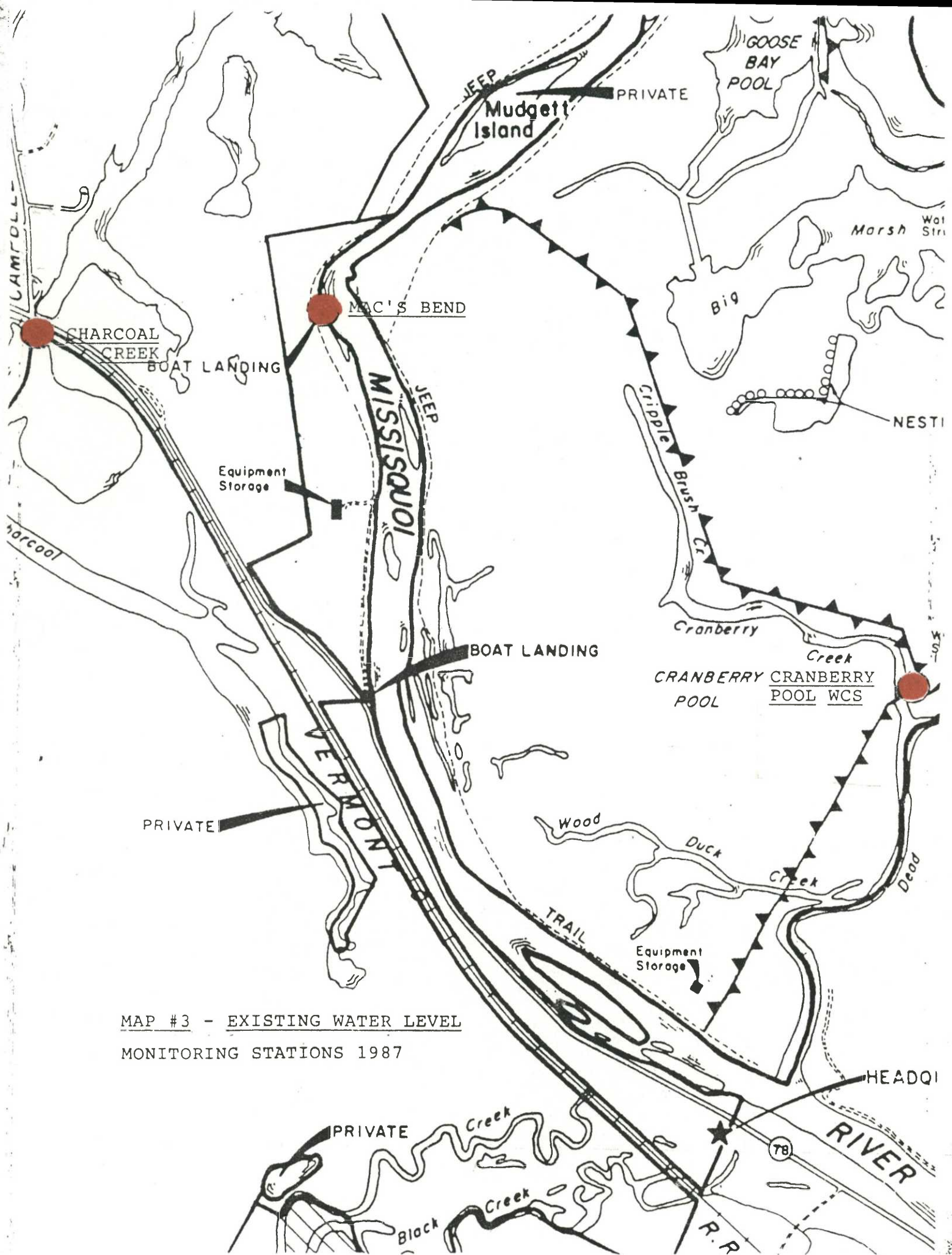
The flooding of Cranberry Pool raised the interior water levels to a peak of 98.49' MSL on 4/17, after which it subsided gradually to 98.44' MSL on 4/30. The levels in Dead Creek were low enough on 5/1 for draining of the WMU to commence. All four bays of the water control structure were opened on that day. A lack of rainfall during April (1.91") and the first three weeks of May (0.56") allowed pool levels to be lowered to the objective level (97.20' MSL) by 5/14. Water control structures were closed during weekends at that time of the month to prevent water reentry into the WMU, via the WCS, should Dead Creek levels rise suddenly. Thunderstorms during the last few days of May and during June raised pool levels to 97.31' MSL on 6/10. Evapo-transpiration lowered pool levels to approximately 97.16' MSL by 6/30. Limited rainfall and sunny weather caused pool levels to drop gradually during July and August to 96.70' MSL. Thereafter, this WMU fluctuated correspondingly with significant rainfalls, from 96.70' MSL (9/1) to 96.91' MSL (9/14) and back down to

96.85' MSL during the first half of October. By the end of October, the water level had dropped to 96.81' MSL, when a rain-fall of 1.41" (10/28) raised it to 96.95' MSL. Further, lighter rains during early November raised the Cranberry Pool level to 96.98' MSL (11/10), after which it subsided slightly to 96.90' MSL (11/24). A 2.36" rainfall during 11/26 - 11/28 raised the pool level to 97.02' MSL during early December. Rains thereafter continued raising the pool level, until 12/17, when it read 97.32' MSL. The WCS station froze solid after that date and further readings were not possible.

First ice appeared on the Cranberry Pool during 11/21. However, mild temperatures throughout the rest of November opened much of the area. The ice reformed during mid-December. By the end of the third week of December, the Cranberry Pool and all other open-water refuge areas were completely ice-locked, much later than last year's complete ice-up, during the third week of November.

During 1987, three water monitoring stations were used to determine water levels in Charcoal Creek, the Missisquoi River and Cranberry Pool. These stations are illustrated on Map #3. The Missisquoi River Station ("Mac's Bend") was used during 1987, for the first time in many years, to determine whether the water regimes of the Missisquoi River - Dead Creek systems were noticeably different from that of Lake Champlain.

This issue first surfaced during 1985 - 1986, when refuge staff detected a "time lag" between when the water levels of the River-Creek system rose and when the Lake level rose. In addition, it appeared that the River-Creek system maintained higher water level peaks than did Lake Champlain (Ref. 1986 Missisquoi NWR "Annual Narrative Report," P. 19).

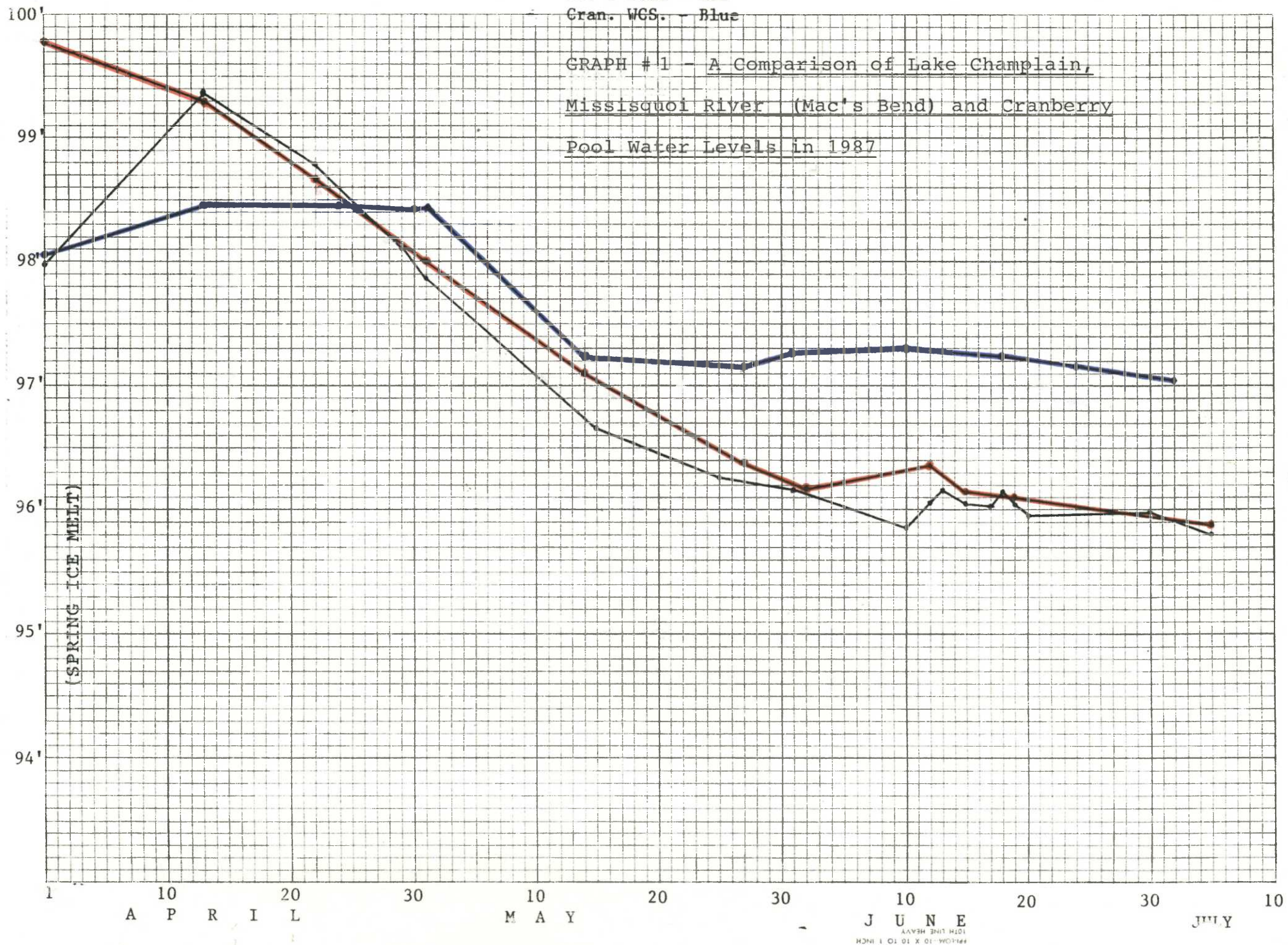


MAP #3 - EXISTING WATER LEVEL
MONITORING STATIONS 1987

Graph #1 illustrates the water level readings for Lake Champlain, the Missisquoi River and Cranberry Pool, together, for comparison, during the high-water season (April - June). The graph appears to substantiate both the "time lag" and peak high-water level differences between Lake Champlain and the Missisquoi River - Dead Creek system. Most noticeable is the yearly - April differences in water level, when Lake Champlain levels were much lower than the Missisquoi River's. In addition, throughout the month of May, the Missisquoi River maintained consistently higher levels than Lake Champlain. Twice-weekly checks of the Mac's Bend Station will be conducted during 1988 for a closer examination of the smaller peaks and lows that appeared in the Lake Champlain readings during June and were not detected in the Missisquoi River, due to a lesser number of readings. In addition, the Regional Engineering Office has been asked to confirm the bench-mark elevation and site this year, to insure the accuracy of the Mac's Bend Station.

L.C.T. Co. - Black
 Mac's Bend - Red
 Cran. WGS. - Blue

GRAPH #1 - A Comparison of Lake Champlain,
 Missisquoi River (Mac's Bend) and Cranberry
 Pool Water Levels in 1987



During 1987, three vegetation transects were conducted by Assistant Manager Gallegos and Outdoor Recreation Planner Blaskowski across the northern Cranberry Pool interior. The transects were conducted to assist Vermont State Fisheries Biologist Jon Anderson in analyzing impacts to existing pike and bullhead spawning habitat, should completion of the Cranberry Pool dike along the western side of the impoundment, where spring flooding occurs, become a reality. The final report was completed during the winter of 1987 - '88 and forwarded to Mr. Anderson. A copy of the report was also sent to Zone Biologist Gerry Atwell. Table # 4 reflects all of the plant species encountered during the transects. Predominant plant species were: wild rice, big burreed, buttonbush, broad-leaved arrowhead, coontail, floating-leaf pondweed, pickerelweed, white water lily, duckweed, waterweed, beggar-ticks and rice cutgrass. Topographical features and bottom elevations were also included during the transects.



View of one of the vegetation transects
across the Cranberry Pool. JBG



Typical closeup of some of the emergents
in the Cranberry Pool. JBG

TABLE #4 1987 CRANBERRY POOL TRANSECT - PLANT SPECIES

TERRESTRIAL PLANTS

Aster, New England	- <u>Aster novae-anglia</u>
Aster, small white	- <u>Aster vimineus</u>
Bedstraw, fragrant	- <u>Galium triflorum</u>
Beggar-ticks	- <u>Bidens frondosa</u>
Bindweed, hedge	- <u>Convolvulus sepium</u>
Bluets	- <u>Houstonia caerulea</u>
Cardinal flower	- <u>Lobelia cardinalis</u>
Cleavers	- <u>Galium aparine</u>
Clover, yellow sweet	- <u>Melilotus officinalis</u>
Ditch stonecrop	- <u>Penthorum sedoides</u>
Dock, curled	- <u>Rumex crispus</u>
Dodder	- <u>Cuscuta gronovii</u>
Dogbane, spreading	- <u>Apocynum androsaemifolium</u>
Forget-me-not, true	- <u>Myosotis scorpioides</u>
Goldenrod	- <u>Solidago sp.</u>
Groundnut	- <u>Apios americana</u>
Grape, fox	- <u>Vitis labrusca</u>
Hog peanut	- <u>Amphicarpa bracteata</u>
Jack-in-the-pulpit	- <u>Arisaema atrorubens</u>
Jewelweed	- <u>Impatiens capensis</u>
Joe-Pye-weed, spotted	- <u>Eupatorium maculatum</u>
Knotweed	- <u>Polygonum crectum</u>
Lobelia	- <u>Lobelia sp.</u>
Milkweed, common	- <u>Asclepias syriaca</u>
Milkweed, swamp	- <u>Asclepias incarnata</u>
Millet, Japanese	- <u>Echinochloa crusgalli</u>
Monkey-flower, square stemmed	- <u>Mimulus ringens</u>
Mullein, moth	- <u>Verbascum blattaria</u>
Nettle, slender	- <u>Urtica gracilis</u>
Nettle, stinging	- <u>Urtica dioica</u>
Nightshade, common	- <u>Solanum dulcamara</u>
Peppergrass	- <u>Lepidium sp.</u>
Plaintain, common	- <u>Plantago major</u>
Primrose, common evening	- <u>Oenothera biennis</u>
Ragweed, common	- <u>Ambrosia artemisiifolia</u>
Rue, tall meadow	- <u>Thalictrum polygamum</u>
Skullcap, common	- <u>Scutellaria epilobiifolia</u>
Smartweed, common	- <u>Polygonum hydropiper</u>
Smartweed, Pennsylvania	- <u>Polygonum pensylvanicum</u>
St. Johnswort, dwarf	- <u>Hypericum mutilum</u>
St. Johnswort, marsh	- <u>Hypericum virginicum</u>
Tearthumb, arrow-leaved	- <u>Polygonum sagittatum</u>
Vervain, blue	- <u>Verbena hastata</u>
Vetch, cow	- <u>Vicia cracca</u>
Water hemlock	- <u>Barbarea vulgaris</u>
Water horehound	- <u>Lycopus sp.</u>

AQUATIC PLANTS

Arrowhead, broad-leaved	- <u>Sagittaria latifolia</u> var.
Arrowhead, sessile-fruited	- <u>Sagittaria rigida</u>
Algae, green	
Bladderwort, greater	- <u>Utricularia vulgaris</u>
Burreed, unknown sp.	- <u>Sparganium</u> sp.
Burreed, big	- <u>Sparganium eurycarpum</u>
Celery, wild	- <u>Vallisneria americana</u>
Cinquefoil, marsh	- <u>Potentilla palustris</u>
Common three-square	- <u>Scirpus americanus</u>
Coontail	- <u>Ceratophyllum demersum</u>
Duckweed	- <u>Lemna minor</u>
Lily, bullhead	- <u>Nuphar variegatum</u>
Lily, fragrant white	- <u>Nymphaea odorata</u>
Milfoil, Eurasian water	- <u>Myriophyllum spicatum</u>
Pickerelweed	- <u>Pontederia cordata</u>
Plantain, water	- <u>Valisnia Plantago-aquatica</u>
Pondweed	- <u>Potamogeton natans</u>
Pondweed, floating-leaf	- <u>Potamogeton natans</u>
Pondweed, large-leaved	- <u>Potamogeton amplifolius</u>
Pondweed, ribbon-leaf	- <u>Potamogeton epihydrus</u>
Rice, wild	- <u>Zizania aquatica</u>
Sedge	- <u>Carex crinita</u>
	- <u>Carex retrorsa</u>
	- <u>Carex tribuloides</u>
Sedge, three-way	- <u>Dulichium arundinaceum</u>
Spikerush, blunt	- <u>Eleocharis obtusa</u>
Spikerush, unknown sp.	- <u>Eleocharis</u> sp.
Watershield	- <u>Brasenia schreberi</u>
Waterweed	- <u>Elodea canadensis</u>
Woolgrass	- <u>Scirpus cyperinus</u>

FERNS

Cinnamon fern	- <u>Osmunda cinnamomea</u>
Marsh fern	- <u>Thelypteris palustris</u>
Massachusetts fern	- <u>Thelypteris simulata</u>
New York fern	- <u>Thelypteris noveboracensis</u>
Sensitive fern	- <u>Onoclea sensibilis</u>
Royal fern	- <u>Osmunda regalis</u>

GRASSES

Johnson grass	- <u>Sorghum halepense</u>
Millet	- <u>Panicum miliaceum</u>
Panicgrass	- <u>Panicum</u> sp.
Rice cutgrass	- <u>Leersia oryzoides</u>

TREES

Ash, white	- <u>Fraxinus americana</u>
Birch, American white	- <u>Betula papyrifera</u>
Cottonwood, common	- <u>Populus deltoides</u>
Elm, American	- <u>Ulmus americana</u>
Maple, silver	- <u>Acer saccharinum</u>
Willow, black	- <u>Salix niger</u>

SHRUBS

Alder, speckled	- <u>Alnus rugosa</u>
Buttonbush	- <u>Cephalanthus occidentalis</u>
Unknown shrub	- (Mountain Holly - <u>Nemopanthus mucronata</u> ?)

MOSS

Sphagnum moss	- <u>Sphagnum sp.</u>
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The other unregulated wetlands on the Missisquoi River Delta and the more interior portions of the refuge are directly influenced by Lake Champlain water levels. In these areas, wild rice also predominated along the more sheltered shorelines of Goose and Gander Bays, Shad Island Bay and Pothole, Metcalfe Island Bay and Pothole, Long Marsh Bay and Channel, and Saxe's Pothole. In the lake-shore marshes and wooded swamps, arrowhead, pickerelweed, pondweeds, wild celery and hardstem bulrush also experienced an excellent production year. Hardstem stands along the lake-shore are often used as cover by goldeneye broods in this area.

The current general water management policy practiced during 1987 was one of getting the spring water levels down to 97.20' MSL as soon as possible to provide puddleduck nesting habitat, and holding the water at that level throughout the rest of the year. This policy appears to best meet the objectives of the new Water Management Plan by providing the most acreage of open water with a depth of two feet or less. Waterfowl food and cover plants respond well to such a

program, as do waterfowl, wading birds and mammals. However, if spring floodwaters are excluded, the need for a draw-down during the waterfowl nesting season here (early April-early June) should be precluded, and ground-nesting waterfowl production including that of the black duck, should benefit. Completion of the Cranberry Dike along the northwestern and western low areas of the Cranberry Pool would exclude those spring flood-waters and make this Unit more manageable during the waterfowl breeding season.

During June nesting structure checks in the Metcalfe Island pothole area, the following unusual plant species were noted within and adjacent to the floating spikerush and horsetail mats along the western side: River bulrush (Scirpus fluviatilis), slough sedge (Carex tricocarpa), tufted loosestrife (Lythrum thrysiflora), and sweetgale (Myrica gale). Similar floating spikerush mats and horsetail stands exist along the western shoreline of Long Marsh Channel, and support similar plant associations. These areas appear unique to Missisquoi NWR and merit closer study and research by local college graduate students.

Study of the Maquam Swamp's bog area was encouraged by refuge staff during 1987, through Professor Dr. Daniel Mann of the University of Vermont's Botany Department. The outcome was three study projects by his graduate students that centered on assessing refuge development options of that area, for increased waterfowl use. All three students provided refuge staff with the following conclusions:

1. The Maquam Swamp's acid-rain bog area is probably the largest open peatland in Vermont.
2. The pitch pine community in the bog is perhaps the largest and most pristine in Vermont, and of great biological interest.

3. The Virginia chain-fern (Woodwardia virginica) and few-seeded sedge (Carex sp.) are found in the bog. The chain-fern is classified as "threatened" by the State of Vermont, while the sedge is considered rare.
4. The bog has great potential as a nesting area for the short-eared owl and marsh hawk - classified as "Species of Special Concern" by the State of Vermont.
5. Caution should be practiced in managing this area, since it possesses many natural qualities of State and National significance. Habitat modifications should be avoided.

The above conclusions indicate that perhaps the Maquam Bog is best left as it is. Table #5 provides a general listing of the plant species encountered by the three students during their course work in April. An offshoot of the course project was a formal research proposal by one of the students - Richard Strimbeck - entitled, "Factors Affecting Growth Rate of Bog Pitch Pine." This research project is expected to be completed during 1988 (Ref. Section D.5).

TABLE #5 - PLANT SPECIES OF THE MAQUAM BOG AREA

TREES

Silver maple	- <u>Acer saccharinum</u>
Swamp maple	- <u>Acer fremanii</u>
Red maple	- <u>Acer rubrum</u>
White ash	- <u>Fraxinus americana</u>
Swamp white oak	- <u>Quercus bicolor</u>
Common cottonwood	- <u>Populus deltoides</u>
Black willow	- <u>Salix nigra</u>
Gray birch	- <u>Betula populifolia</u>
Pitch pine	- <u>Pinus rigida</u>
Black spruce	- <u>Picea mariana</u>
Northern white cedar	- <u>Thuja occidentalis</u>
Tamarack	- <u>Larix laricina</u>

SHRUBS

Small cranberry	- <u>Vaccinium oxycoccus</u>
Large cranberry	- <u>Vaccinium macrocarpon</u>
Lowbush blueberry	- <u>Vaccinium stamineum</u>
Highbush blueberry	- <u>Vaccinium corymbosum</u>
Buttonbush	- <u>Cephalanthus occidentalis</u>
Red alder	- <u>Alnus rugosa</u>
Black alder	- <u>Ilex verticillata</u>
Mountain holly	- <u>Nemopanthus mucronata</u>
Leatherleaf	- <u>Chamaedaphne calyculata</u>
Labrador tea	- <u>Ledum groenlandicum</u>
Rhodora	- <u>Rhododendron canadense</u>
Sweet gale	- <u>Myrica gale</u>
Water willow	- <u>Decodon verticillatus</u>
Northern wild raisin	- <u>Viburnum cassinoides</u>
Willow	- <u>Salix sp.</u>
Meadowsweet	- <u>Spiraea latifolia</u>
Sheep laurel	- <u>Kalmia angustifolia</u>
Swamp laurel	- <u>Kalmia latifolia</u>
European white alder	- <u>Alnus incana</u>

FERNS

Chain fern	- <u>Woodwardia virginica</u>
Crested shield fern	- <u>Dryopteris cristata</u>
Cinnamon fern	- <u>Osmunda cinnamomea</u>
A fern	- <u>Polystrichum spp.</u>

SPHAGNUM

Sphagnum teres
S. magellanicum
S. recurvum

GRAMINOIDS

Sedges	- <u>Carex sp./Eleocharis sp./Dulichium</u> <u>arundinaceum</u>
Cottongrass	- <u>Eriophorum sp.</u>
Wild rice	- <u>Zizania aquatica</u>
Burreed	- <u>Sparganium sp.</u>
Cattail	- <u>Typha sp.</u>

AQUATICS

Coontail	- <u>Ceratophyllum demersum</u>
Pondweeds	- <u>Potamogeton spp.</u>
Pickerelweed	- <u>Pontederia cordata</u>
Arrowhead	- <u>Sagittaria spp.</u>

5. Grasslands

Grassland management goals at this station are to continue to improve existing grasslands for nesting waterfowl and wildlife diversity, and to maintain critical habitat for northern pike spawning. Most of the upland fields on the mainland are currently hayed annually to keep the land open. Changes in the management of these fields are planned to accomplish the present goals. Implementation of our revised Grassland Management Plan has proceeded very slowly. The following discussion will provide a brief update of the current status of our efforts.

One of the habitat deficiencies that results from annual haying is the lack of adequate residual cover in the spring. The grasses and forbs regrowth after mowing is too short or it flattens out "lodges" over the winter. A 40-acre field (Field 9) was divided in half with one half left unmowed in 1985. Residual cover on the unmowed access was lodged in the spring of 1986 and in the

spring of 1987. However, there was more residual cover than existed on annually mowed fields.

The rotational mowing was discontinued in 1987. The whole 40- acre field was hayed. This was done because this field, like most of the other fields, have some woody shrub invasion. The fields have not been tilled or replanted for several years. we may need to hay these fields annually to keep the existing brush sufficiently suppressed so that the fields can be kept open with standard haying equipment.

If brush encroachment advances too far, the only way to retard succession by woody shrubs is rotary mowing or possibly prescribed burning. None of the mainland fields are included in approved burn prescriptions at this time.

We will keep our options open with annual haying until we can establish improved cover either through cooperative agreements or force account actions.

A nine-acre reed canarygrass field had been planted in 1980. As part of the cooperative agreement, the farmer cut hay for free for four years. The field was left unmowed as dense nesting cover in 1985. The reed canarygrass lodged during the spring of 1986 and 1987, but there were occasional tufts of upright vegetation in the field. The field was hayed in 1987 because willows were sprouting in the field and if left uncut might have resulted in loss of the field to brush. Apparently, some old willow roots remained alive after the field was tilled and reseeded in 1980. This may mean that our hayfields would have to be tilled annually for two or three years before establishing a permanent grass cover.

We used our tractor and rotary brush mower to cut back encroaching brush on fields bordering Route 78 and about 20 acres bordering the woodland on Field 10/11 (Tabor Road). The Tabor Road site had been hayed last in 1983. This was a relatively moist area most of the years. The vegetation was

mostly reed canarygrass, woolgrass and other sedges and rushes intermixed with brush. We will rotary mow this area every three years.

The seven-acre Alfalfa/Brome grass mix that was planted along Tabor Road in 1983 was hayed until 1986. It was not mowed in 1986 or 1987. This mix seemed to provide some residual cover in the spring. No waterfowl nesting activity occurred but this plot is located adjacent to a public road.

On the island portion of the refuge, we were able to mow the top half of the Cranberry Pool Dike and about 15 acres of old hayfields that had reverted to goldenrod and shrubs. The dike has a heavy growth of trees and shrubs on lower parts of the dike slope. We hope to mow a little more each year to restore the grassy cover of the dikes.



Mowing of dike is complicated by the need to barge our tractor across the river. RAZ



This was the first time since 1984
that we mowed any of the dike. RAZ

Another six acres along Route 78 were mowed in September. The quality of this plot for hay was so poor that no fee had been collected for it in past years. We used it to check out a new 20-horsepower tractor and rotary mower received during the summer.

6. Other Habitats

Some clearings were mowed in our old field which had reverted to alders west of the railroad tracks to improve it for woodcock use. The brush mower was used to make irregular openings and corridors for use as singing grounds.



An old field succeeding to brush was partially mowed to maintain the attractiveness for woodcock use. RAZ

7. Grazing

A Special Use Permit was issued for grazing a 46-acre tract of field and woods along Tabor Road. This was the second year that grazing was used to keep the open areas open. The area was intensely grazed from early May until July 11. Brush that had been suppressed from previous grazing and mowing

was successfully controlled by this activity. Areas where woody shrubs are well established were unaffected. A total of 68 animal unit months (AUMs) was applied in 1987. This appeared to adequately maintain the status quo in cover type on the tract. By the end of the grazing period, the area was showing the general appearance of an overgrazed lot. With grazing withheld for the remainder of the year a mixture of sedges and grasses regrew and a more lush appearance was evident by late August.

This area had been grazed until 1980. Grazing was renewed in 1986 after the fence had been replaced. The previous grazing allowance was 60 AUMs which consisted of ten animals for six months. Currently, we are trying different approaches to see what works best for our needs.

8. Haying

A total of 190 acres of fields were hayed in 1987. The farmers are required to report the number of bales removed. Based on their reports and their estimated bale weights, we sold 310 tons of hay from 190 acres in 1987. Practically all of the hay is low quality since the fields have unpalatable weeds mixed with the grasses and mowing is not allowed until July 15.

The annual haying is presently our main means of keeping these fields open. Less frequent mowing is impractical until we restore those areas to a more satisfactory cover type as discussed in Section 5.

9. Fire Management

A total of 108 acres were burned in 1987 in two prescribed burns, one in the spring and one in the fall.

Unit 3 of the old hayfields on the island was burned on April 16. This burn covered about 63 acres. The fire carried well through most of the open areas and burned saplings and isolated brush. Areas of dense brush or young tree growth were not affected, due to a lack of fuel in the understory.

The area was checked again in May and a good kill of shrubs was noted in areas where the residual grassy fuel was abundant. Larger trees and dense brush were unaffected. On some of the large trees, the lower branches had been killed by the flames burning under the trees.



Some brush was top-killed by a spring burn
in an old field. JBG

A fall burn was carried out on 45 acres of Unit 2 of the old hayfields, on the island, on October 14. This unit had been degenerated to a principal cover of goldenrod with scattered invasion by trees. The goldenrod did not carry a fire very well. There was little fuel on the ground and winds were light.

10. Pest Control

Purple loosestrife control efforts were carried out by the refuge manager and assistant manager using backpack spray equipment.

Map Figure (4) shows areas where purple loosestrife was located in 1987. We did not accomplish as much control work in 1987 as in the previous years. The main reason was lack of time for the manager and assistant manager to spray loosestrife and accomplish other work.



Light infestations of purple loosestrife are scattered throughout refuge marshes.

JBG

Loosestrife plants were sprayed in Cranberry Pool, Big Marsh Slough, the Missisquoi River, Shad Island and part of Metcalfe Island. A small infestation in a field pond and ditch was also treated with RODEO.



Spot treatment of purple loosestrife is effective without disturbing non-target plants. JBG

Overall, the loosestrife infestation is moderate to light. In order to prevent the further spread of this plant and to reduce the present level of infestation, more effort is needed. Hand spraying appears to be the only feasible approach since we are dealing with single plant clumps and scattered patches of a quarter-acre or less. The spot-spraying allows us to kill the pest with a minimum of effect on nontarget plants.

MISSISQUOI NATIONAL WILDLIFE REFUGE FRANKLIN COUNTY, VERMONT

UNITED STATES
DEPARTMENT OF THE INTERIOR
73°14'

UNITED STATES
FISH AND WILDLIFE SERVICE
73°06'

MAP # 4 Purple
Loosestrife Distribution
1987

Purple Loosestrife [—]

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73



We have to recheck treated areas in following years
to catch any seedling sprouts. JBG

Common Reed Grass, Phragmites australis, occurs to a very limited extent at present. A small amount, less than a quarter-acre was successfully controlled in 1986 in the Cranberry Pool area. In 1987, this area was revisited and a few surviving plants were sprayed. A larger, approximately three-acre area of Phragmites that had been discovered in the fall of 1986 in Big Marsh Slough was visited once in the summer of 1987. The refuge manager visited this site in July of 1987 with a backpack sprayer loaded with RODEO herbicide. The futility of this approach was readily evident. The Phragmites was ten-to-twelve feet high and the hand-operated sprayer was not suited to the job.

We will be looking at possibly having this area sprayed by airplane in 1988.

11. Water Rights

Omitted from the "1986 Annual Narrative Report" was the final decision on the long-standing issue of public hunting inside the mean low-water boundary (93.055' MSL) established by the State as lakeshore property boundaries. Since this boundary is under water throughout most or all of a normal year, two local sportsmen (Bill Thomas and Kent Ouimette) decided to challenge the private-use-only implications of such underwater property lines. The following narrative summarizes the case history:

The lawsuit began as a criminal trespassing violation in the adjacent Cabot/Clark Marsh by two local sportsmen (Bill Thomas and Kent Ouimette) in October 1979, and reached the Vermont Supreme Court through an interlocutory appeal granted by the Vermont District Court. Thomas and Ouimette want clarification as to where between the high and low water marks landowners have control.

On November 3, 1981, the Vermont Supreme Court remanded the decision to the lower court. The reason cited for remanding the decision was due to the Supreme Court's aversion to modifying established procedures for judicial decision.

On October 12, 1982, the Honorable George T. Costes, Presiding Judge, District Court of Vermont, found the defendants, R. Kent Ouimette, William Thomas and Robert Thomas not guilty of poaching or trespassing in the Cabot/Clark Marsh. At the same time, civil court action was pending.

During 1983, the controversy continued, as a front-page story appeared in the St. Albans Messenger on March 16, that featured interviews with the defendants and attorney George Spear, counsel for the owners of

Cabot/Clark Marsh. The refuge responded by issuing a news release to counter the story's possible impacts on refuge lakeshore marshes. The crux of the release stated that the Federal mean low-water boundary of 93.055' MSL remains in effect, regardless of recent State District Court actions. No legal action occurred during the rest of 1983.

On February 23, 1984, Franklin County Superior Court Judge Alan Cheever ruled against the three defendants. In his decision, Judge Cheever ruled: ".....lakeshore boundaries run to the low and not the ordinary high water mark." A permanent injunction was also issued against the defendants to prevent them from boating in the Cabot/Clark Marsh in West Swanton.

Attorneys for the defendants filed an appeal to the Vermont Supreme Court. The file was certified to the Vermont Supreme Court on May 24, 1984. On October 2, 1985, the matter was heard before the full Court.

On June 30, 1986, local attorney George Spear, who represented the Cabot/Clark landowners, notified refuge staff that the Vermont Supreme Court had upheld the 93.055' MSL lakeshore boundary line. This was a final ruling, and good news for Missisquoi NWR, since it also maintains a similar boundary along its nine or ten miles of lakeshore properties.

G. WILDLIFE

2. Endangered and/or Threatened Species

The only Federally endangered or threatened species using Missisquoi NWR during 1987 were the bald eagle and peregrine falcon.

The following species are classified as "Endangered, Threatened or Rare," by the State of Vermont:

- | | | | |
|----|-----------------------------------|---|------------|
| a. | Bald Eagle | - | Endangered |
| b. | Peregrine Falcon | - | Endangered |
| c. | Osprey | - | Endangered |
| d. | Common Loon | - | Endangered |
| e. | Common Tern | - | Threatened |
| f. | Upland Sandpiper | - | Threatened |
| g. | Eastern Spiny Soft-shelled Turtle | - | Threatened |

Bald eagle sightings continued to be rare during 1987. Refuge staff observed one adult bird on a tall snag on the southern shore of Goose Bay on June 30, while one definite and one probable bald eagle were observed south of the refuge in the Hawkins Bay - Cedar Island area of Lake Champlain during the Annual Mid-winter Aerial Waterfowl Survey, on January 6, 1987. A report was received on October 18 by a Tammy Kinney of a golden eagle along the shoreline of Goose Bay. This may have been a bald eagle, since Golden Eagles have never been reported before on-refuge.

On August 20, refuge staff observed two peregrine falcons over the Cranberry Pool stooping on one another and "tail-nipping" while in flight. Their calls caught the staff's attention immediately. The flights lasted approximately two minutes before the pair moved out of view.

Ospreys continue to be the most frequently observed State endangered species using the refuge and surrounding area. They are not known to nest on-refuge. However, refuge staff met with Vermont Fish and Wildlife Nongame Biologist Diane Jay during October to assess potential locations in Metcalfe Island, Goose Bay Pool and Long Marsh Channel for osprey nesting platforms. Installation may take place during the late winter of 1988 or 1989, when the power company's equipment can easily travel over the ice. The first osprey sighting on-refuge was on May 5, at the mouth of the East Branch of the Missisquoi River. They continued to be occasionally seen throughout the summer until mid-September, in the vicinity of the Missisquoi River's three branches. The estimated number of osprey use-days for CY 1987, totaled 310, the same as in 1986.

The common loon is only an occasional visitor during migration, since it prefers the deeper waters outside the refuge boundaries. Populations in the area are low, and State recovery efforts are underway along Lake Champlain's few known breeding locations. Refuge staff only observed loons once, on April 17, in Gander Bay. Estimated use of the refuge lakeshore properties by this diver during CY 1987 was 15 use-days, below the 35 use-days of 1986, and the 27 use-days of 1985.

Common terns use the refuge lakeshore areas especially the mouths of the three Branches (West, Middle and East) and the mouth of Dead Creek - primarily as a staging area during the fall migration. No nesting on-refuge is presently known. Vermont State Nongame Biologists are presently also working on a recovery program for this vanishing Lake Champlain breeder. Estimated use of the refuge by this tern during CY 1987 was 2,000 use-days, below the totals for both 1986 (2,650 use-days) and 1985 (2,350 use-days).

The upland sandpiper is estimated to have spent 20 use-days on the Missisquoi Refuge during 1987. One was observed by refuge staff on May 29, along the northern Gander Bay shoreline, near Saxe's Pothole. These birds are rarely seen in this area.

Information on the spiny, soft-shelled turtle is contained in Section G.10 of this Narrative.

The least bittern, pied-billed grebe, northern harrier, short-eared owl, map turtle and New England cottontail are formally listed by the State of Vermont as "Species of Special Concern in Vermont." The pied-billed grebe is the most common bird species of this group, and is the only one known to nest within the southern Cranberry Pool area of the refuge consistently. Calendar use-days for these avian "Species of Special Concern in Vermont" follow. The map turtle and cottontail rabbit are covered in Sections G.10 and G.8, respectively.

SPECIES	1987	1986	1985
1. Least bittern	480	465	450
2. Pied-billed grebe	2,400	2,700	2,800
3. Northern harrier	325	585	525
4. Short-eared owl	19	5	3

Surveys of the Maquam Swamp's Bog area during the spring and summer of this year by refuge staff and University of Vermont graduate students revealed the presence of a 3/4 acre stand of Virginia Chain Fern (Woodwardia virginica) in the western end of the recently-acquired (1984) former Comolli property. This fern is classified as a "threatened" species by the State of Vermont. This site is the only known location of Virginia Chain Fern in the area.

3. Waterfowl

First waterfowl arrivals during the 1987 spring migration are listed below, together with the date on which they were first observed by refuge staff. Those species whose first arrival dates were missed are not listed.

Goldeneye	-	March 12
Mallard	-	March 24
Black duck	-	March 24
American merganser	-	March 24
Bufflehead	-	March 25
Snow goose	-	March 26
Hooded merganser	-	March 30
Ring-necked duck	-	March 30
Pintail	-	March 30
Gadwall	-	March 30
Green-winged teal	-	March 30
Wood duck	-	March 30

The unusually warm weather at the end of March appeared to result in an early start of the spring migration, with concentrations of ducks showing up in Big Marsh Slough, Goose Bay Pool, Cranberry Pool and the mouths of Dead Creek and the branches of the Missisquoi River during the last week of March.

- a. Spring Migration - Duck population on-refuge peaked during early April, at approximately 1,500 birds, before subsiding gradually as the migrants continued further north. Ring-necked ducks (300) were not as numerous as in past years (approximately 1,000-1,200) resulting in an overall peak

spring waterfowl population considerably lower than the peaks for 1986 (2,230) and 1984 (nearly 5,000). The majority of the April peak consisted of black ducks ring-necked ducks, American mergansers, mallards, green-winged teal and goldeneyes, in descending order of frequency. Wood ducks and blue-winged teal peaked late in April.

Analysis of the species composition of the peak spring migration through the refuge provided the following population trend, when compared with the 1986 peak.

Black duck	-	Same
Mallard	-	Slight Increase
Pintail	-	Decrease
GWT	-	Increase
BWT	-	Slight Increase
Gadwall	-	Decrease
Widgeon	-	Slight Increase
Shoveler	-	Same
Wood duck	-	Increase
Canada Goose	-	Slight Increase
Ring-neckeds	-	Decrease
Bufflehead	-	Same
Ruddy	-	Slight Decrease
American merganser	-	Increase
Hooded merganser	-	Increase
Goldeneye	-	Increase

- b. Breeding Season - As in 1986, the below-average rainfall during April (1.91") provided staff with an earlier draw-down opportunity than usual for Water Management Unit #2 (WMU #2) - the Cranberry Pool - water levels. Grassy hummocks and edge habitats were available for such ground-nesters as the mallard, black duck and blue-winged teal during early May.

Waterfowl breeding pair surveys were conducted by refuge staff and two volunteers (Greg Simard and Norbert Blaskowski) during April 30 through May 6. The entire refuge was surveyed. A total of 253 pairs of ducks were counted. The count broke down as follows:

- 73 wood ducks
- 66 mallards
- 40 green-winged teal
- 29 goldeneyes
- 26 black ducks
- 7 blue-winged teal
- 4 hooded mergansers
- 1 pintail
- 7 unknowns

Paired ducks not known to breed on-refuge are not included. The increase in green-winged teal pairs led staff to expect a major increase in their production this year. However, as Section c. below points out, this was not the case. Blue-winged teal pairs were lower than in previous years. The above results reflected an increase of 38.3% over the number of 1986 breeding pairs, and an increase of

26.5% over 1985 pairs. Part of this increase may be attributable to a more efficient survey system this year, that covered some wet field areas missed in past years. all species of resident ducks reflected a significant increase in pair numbers except for the blue-winged teal, with wood ducks and green-winged teal showing the greatest gains.

- c. Waterfowl Brood Surveys - Intensive brood surveys were conducted during the period of June 19 - July 2, using primarily the tree stand observation method prescribed by the "Bennett Technique." However, in those areas where tree stand observations were not possible, outboard motorboat, canoe and foot surveys were undertaken, and incidental observations utilized during the survey periods. The entire refuge was surveyed, as in 1986. The survey was the most extensive and accurate to date this year, with 11 tree stands manned by refuge staff and five volunteers. Surveys were conducted during early morning and pre-sunset 2-1/2-hour periods. Because the entire refuge is being surveyed, and all tree stands are equally manned (for the prescribed three surveys of 2-1/2-hours per tree stand), the Bennett Technique terms - "primary" and "secondary" with regard to observations stands will no longer be used. Existing and proposed (to be built during 1988 and 1989) brood survey observation stands are shown on Map #5.

$$Q = \frac{B}{\text{Log } (N + 1)} ; Q \times \log (54 \times Q)$$

where,

B = The total number of different broods observed.

N = The total number of all broods observed, including repeats.

Table #6 below, provides a breakdown of brood data acquired from the surveys.

TABLE #6 - FINAL BROOD ESTIMATES - 1987

UNIT NAME AND NUMBER	# ACTUALLY OBSERVED	SURVEY TECHNIQUE(s)	EST. # BROODS
Long Marsh (#1)	4	Bennett, Boat and Incidental	12
Metcalfe Island (#2)	4	Bennett, Boat and Incidental	7
Shad Island (#3)	3	Boat and Incidental	5
Gander Bay (#4)	4	Boat and Incidental	8
Goose Bay (#5)	5	Bennett and Boat	17
Goose Bay Pool (#6)	2	Bennett	17
Big Marsh Slough (#7)	7	Bennett	17
Dead Creek (#8)	2	Boat and Incidental	4
Cranberry Pool (#9)	20	Bennett	37
Missisquoi River (#10)	1	Boat and Incidental	3
Charcoal Creek (#11)	4	Canoe (2)	8
Black & Ma- quam Creeks (#12)	2	Canoe (1)	
Maquam Swamp (#13)	8	Bennett and Foot (2)	14
ACTUAL TOTAL BROODS	66	ESTIMATED TOTAL BROODS	155* (159)

*The estimated total number of broods produced (From Table 6) for 1987 is 155. However, no black duck or green-winged teal broods were observed. The high number of breeding pairs of these two species noted during the spring, leads us to believe that some broods must have been produced and missed during the surveys. Therefore, two black duck and two green-winged teal broods have been added on to the final estimate for the total number of broods (6 ducklings per brood). This raises the final estimate to 159.



A brood of wood ducks observed from one of our observation platforms. JBG

Completion of the remaining six proposed observation stands shown on Map #5, will decrease brood data dependency upon "Incidental" observations of broods, during non-survey functions, and increase data dependency upon the more reliable Bennett Technique (Ref. Table #6) in the Shad Island, Gander Bay and Metcalfe Island areas.

The total number of broods estimated for 1987 is 23 more than in 1986, and 22 more than in 1985. Waterfowl production, based on brood observations is provided in Table #7 below.

The average brood size during 1987 was larger than previous years for wood ducks and the same for other ducks.

MISSISQUOI NATIONAL WILDLIFE REFUGE

FRANKLIN COUNTY, VERMONT

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

UNITED STATES
FISH AND WILDLIFE SERVICE

MAP # 5 - EXISTING AND PROPOSED

BROOD SURVEY OBSERVATION STATIONS (TREE STANDS)

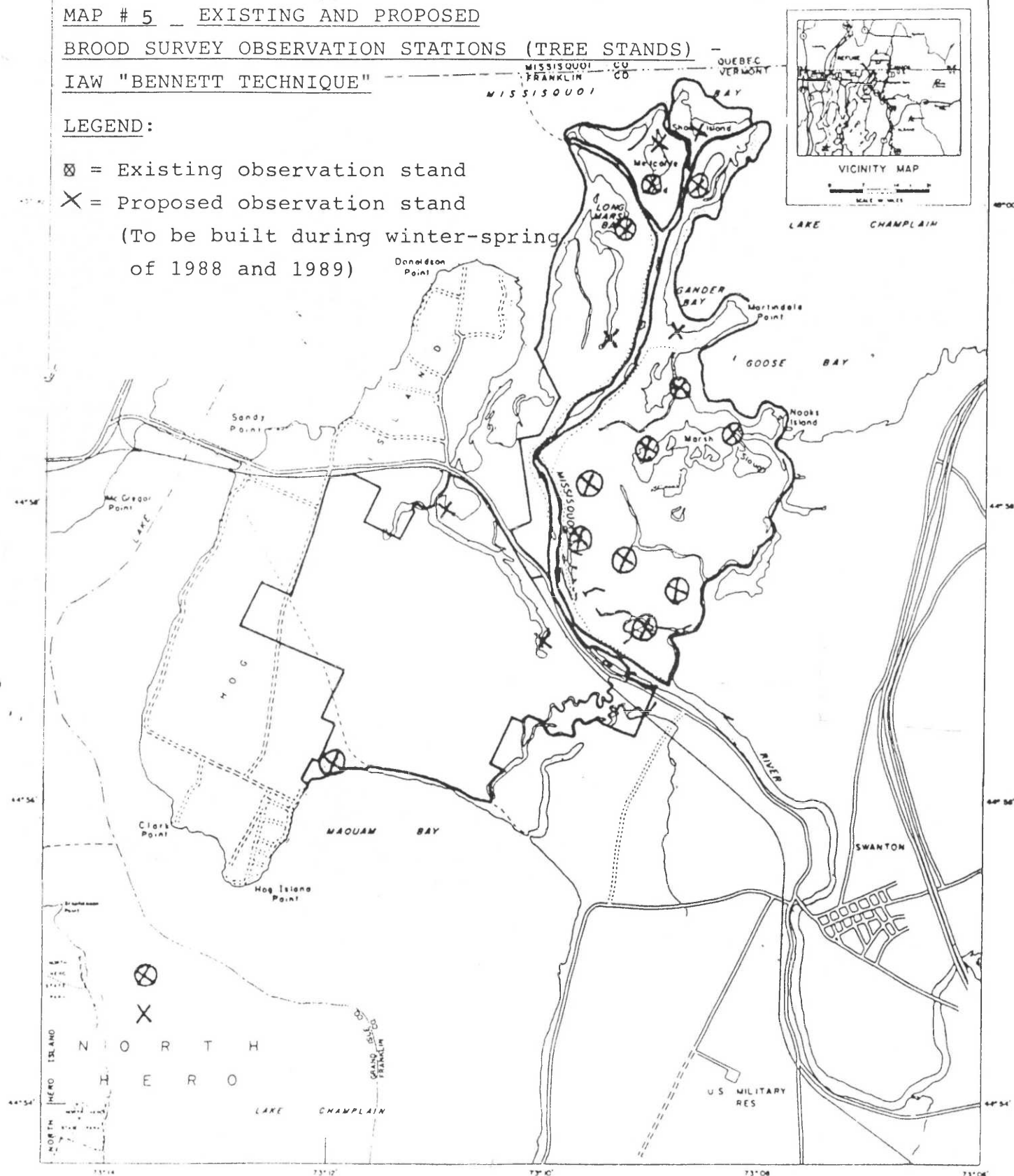
IAW "BENNETT TECHNIQUE"

LEGEND:

⊗ = Existing observation stand

✕ = Proposed observation stand

(To be built during winter-spring
of 1988 and 1989)



COMPILED IN THE BRANCH OF ENGINEERING FROM
SURVEYS AND AERIAL PHOTOGRAPHS OF 1962
BY G.S. AND T.B.S.

BOSTON, MASSACHUSETTS

FEBRUARY, 1966

Scale 0 20 40 60 80 100 CHAINS
0 1 2 3 4 5 MILES

MEAN
DECLINATION
1960

TABLE #7 - 1981 - 1987 ESTIMATED WATERFOWL PRODUCTION

SPECIES	1981	1982	1983	1984	1985	1986	1987
Wood duck	385	385	450	136*	322	281	664
Goldeneye	125	165	200	250	285	175	282
Mallard	345	200	200	200	114	118	235
Black duck	205	80	50	50	8	33	12
B.W. Teal	70	65	100	100	5	35	16
G/W Teal	--	--	--	--	--	27	12
Hooded Merganser	15	25	20	24	30	10	40
TOTAL DUCKS	1,145	920	1,020	760	764	679	1,261

*May be due to error on new surveyor's part.

The estimated waterfowl production for 1987 was 46.2% higher than in 1986, 39.4% higher than in 1985, and represents a new peak high production year for this station. As shown in Table #7 above, the greatest increases were in wood duck and mallard production. The increase in wood duck production can be related to increased efficiency of brood surveys - in that tree stand observations were conducted in some areas for the first time this year, as well as increased use of 41 new wooden boxes that have been placed throughout the refuge during the past three years. The mallard

production increase is attributed to the second consecutive low-water spring experienced during 1987 that resulted in increased availability of ground-nesting habitat, earlier than usual in the duck's breeding season. Normally, these nesting areas are under water, or very wet, until early May, when most of the local mallard and black duck nesting season has lapsed.

- d. Post-breeding Season - Concentrations of post-breeding males and nonbreeding females gathered in the shrub swamp areas within and around the Cranberry Pool and the connector ditches of Goose Bay Pool and Big Marsh Slough during early June. During that time, surveys of those areas revealed approximately 285 mallards, 160 wood ducks and 65 black ducks, in addition to the usual summer resident population.

Molting ducks continued to use the refuge interior areas (Big Marsh Slough, Goose Bay, Long Marsh Channel and Cranberry Pool) with buttonbush cover throughout June-August. Molting wood ducks, mallards and ring-neckeds used the refuge on a level with last year's populations. Ring-necked duck molting appeared to continue into late September, since the "flappers" of this species were still being observed then.

After the usual buildup of post-breeding males, there seems to be a continual turnover of adult birds, both male and female, on the Missisquoi Delta throughout the summer molting period. However, the influx of females into the area in late summer to molt does not appear to reach the magnitude of the early summer buildup of males.

- e. Nesting Structure Program - The 100 metal nest-cans, 58 wooden boxes and 8 puddle-duck structures were serviced during January and February, when favorable ice conditions permitted safe snowmobile access to all refuge wetlands. The original number of metal cans (106) was reduced by 6, to accommodate 11 new wooden boxes that were added. Since the 6 cans had been consistently not used by waterfowl during the last 5 years, their removal helped keep the total number of nesting structures and accompanying survey and maintenance costs down. Two cone-type, fiberglass, puddle-duck nesting structures were added, in the connecting ditch between Goose Bay Pool and Big Marsh Slough. The wooden wood duck boxes were constructed as a special project by the woodworking class of nearby Missisquoi Valley Union High School, for use on-refuge (See Section E.4 of this Narrative). No duck use of any of the 8 puddle-duck nesting structures occurred during 1987. The new, wooden wood duck boxes were placed in the "connecting ditches" between Cranberry Pool, Big Marsh Slough and Goose Bay Pool (5), Big Marsh Slough dike (1), Metcalfe Island's Pothole (3), Saxe's Pothole (1) and the northern Gander Bay shore (1). All new boxes were placed on trees, except for the 3 in Metcalfe Pothole and 2 in a "connector ditch." These 5 were mounted on our standard 2" galvanized steel pipes in more open areas where metal nest boxes had not been very successful. Only 1 of those 5 boxes had any waterfowl production during 1987 (however, that is one more than with the cans in those same locations). An additional 10 wooden boxes are planned for placement during late February - early March of 1988, in those areas showing low and high use.

Of the 158 nesting cans and boxes available for waterfowl use during 1987, 77 were utilized, for a 48.7% use rate. Five wooden boxes were successfully used twice by wood ducks (2 - Long Marsh area, 2 - Wood Duck Creek in Cranberry Pool, and 1 - Maquam Beaver Pond) this year. Each of these boxes hatched out 2 large wood duck broods (12 - 15 ducklings/hatch). Of the 77 nesting structures utilized, 3 contained dump nests, one was abandoned, and 73 were successful hatches, for a success rate of 46.2%. These use and success rates are higher than the rates of 1984 and 1985, and nearly equivalent to that of 1986. Of the 77 nesting structures utilized, 37 were metal cans, and 40 were wooden boxes. Use of metal cans would probably have been higher, but for the painting of a dozen or more cans black, during the winter maintenance program. Most of the "black cans" had been consistently used by goldeneyes in past years, but may have gotten too hot for use this year. Several of the cans showed signs of occupancy (down, nest hollow, etc.), however, eggs were not laid. These cans will be repainted the original flat gray during the 1988 winter maintenance program. The use rate for cans was 37% this year, while that for wooden boxes was 69%. Wood ducks continue to prefer the wooden boxes mounted on trees in wooded swamp, while goldeneyes seem to prefer the metal stovepipe "cans" mounted on pipes in the open, over marsh or water.

Nesting structure surveys provided an estimated "successful duckling hatch" of 355 wood ducks, 338 goldeneyes and 38 hooded mergansers. The total (731 ducklings) is higher than the 656 ducklings hatched out in 1986, and the 494 ducklings of 1985. (A "successful duckling hatch" is when a duckling hatches and leaves the nesting structure. Dead ducklings found in a nestbox are not counted.) Production

of both goldeneye and wood ducks was higher this year than the 306 and 303, respectively of 1986. The hooded merganser hatch was lower than the 47 of 1986, however, despite a higher number of nesting structures (9) used this year. Most hooded merganser use was confined to dropping eggs in wood duck and goldeneye nests which explains the seeming conflict.

The average hatch per nesting structure this year was 10.0 ducklings, a bit lower than the 10.1 of 1986. Prior years' average hatches per nesting structures were: 1985 - 9.7; 1984 - 6.2; and 1983-7.6.

The remaining nesting structures not utilized by waterfowl were principally used by common grackles (several nest-cans had grackle nests built over older goldeneye nests).

A few other cans were utilized by great-crested flycatchers and tree swallows, or were not used at all. Cans that remain unused by waterfowl for 3 - 5 consecutive years, are relocated.

Despite a thriving raccoon population, no nesting structures showed signs of predation. Tin sheets obtained from a local newspaper are nailed (in two rows) around the trunks of nestbox trees, with as few nails as possible, and serve as excellent predator guards. Nest-cans are mounted atop 2" galvanized steel pipes, which are kept well greased (See photos).



Metal nest boxes which have been used
successfully over the years. JBG



Wooden boxes are readily utilized in the wooded swamp. JBG

No thefts of goldeneye or wood duck eggs are known to have occurred during 1987. The combination of low-water levels and raising the nest-cans two feet higher may have discouraged the thieves that have been raiding the nest-cans in the Saxe's Pothole and Saxe's Creek area for years. (A ladder is now required to reach those cans.)

- f. Fall Migration - Waterfowl populations doubled during August as fall migrants began arriving. Mallards and wood ducks reflected the greatest increases, with lesser numbers of black ducks, blue-winged and green-winged teal, and widgeon also appearing in refuge pools and bays. The peak August waterfowl population was estimated at 2,800 ducks, well above the 1986 peak of 500 birds, and more in line with the 2,755 ducks for August 1985. The low duck use trend of August 1986 may be attributable to the higher than normal water levels of that time, that probably held waterfowl on flooded farm fields in Canada.

The peak waterfowl population during the fall migration occurred during 9/20 - 9/30, when an estimated 13,655 ducks were using the refuge. This peak consisted of approximately 8,000 ring-neckeds; 3,500 mallards; 1,000 mallards; 100 black ducks; and scatterings of green-winged teal, pintails, widgeon and coots. The ring-necked duck population was below the 11,250 birds of September 1986, however, as approximately 8,000 were counted in Big Marsh Slough, Goose Bay Pool and Gander Bay during September 28 - 30. Ring-necked duck use on-refuge has increased during the past ten years, and this diver comprises the bulk of refuge waterfowl migrants.

Ring-necked duck numbers remained at a high level (4,000 - 8,000) throughout most of October and combined with increased mallard, black duck and green-winged teal use, to make October the peak waterfowl use month of 1987. The peak October population of approximately 16,600 birds consisted of an estimated 5,180 mallards; 1,600 black ducks; 8,000 ring-neckeds; 800 green-winged teal; 250 wood ducks; 110 widgeon; 280 snow; and 80 Canada geese, and lesser numbers of gadwalls, pintails,

shovelers, mergansers and other divers. The October peak was well above the 1986 peak of 15,530. With the ring-necked duck population subtracted, the mallard, black, wood duck and teal populations were back on a level with the October duck uses of 1984 and 1985. These puddle-ducks maintained lower numbers during 1986, when high-water levels probably discouraged refuge use.

November waterfowl populations subsided gradually, until an 11/20-11/24 freeze-up reduced refuge waterfowl numbers from 2,500 to zero. Less than 100 birds returned during the last week of November, when a thaw opened refuge waters once again. Waterfowl use during November averaged 1,500 mallards; 700 black ducks; 100 wood ducks; 1,000 ring-necked ducks; 40 buffleheads; 30 hooded mergansers; and a scattering of other divers.

December was a surprise, as unseasonably mild weather reopened the waters along parts of Missisquoi and Gander Bays, and 1,000 - 1,500 American mergansers; 150 - 200 Canada geese; and mixtures of mallards, black ducks, goldeneyes, ring-neckeds and great blue herons were counted within and adjacent to the refuge. Most puddle-ducks were observed at the mouths of the three "branches" of the Missisquoi River and at the mouth of Dead Creek, while the divers were concentrated along northern Gander Bay. Normally all refuge wetlands are frozen throughout December and experience little to no waterfowl use. The peak December waterfowl population of 2,300 birds (of which 1,760 were American mergansers), took place during December 9 -11. Final freeze-up occurred during the last week of December, at which time waterfowl populations once again dropped to zero.

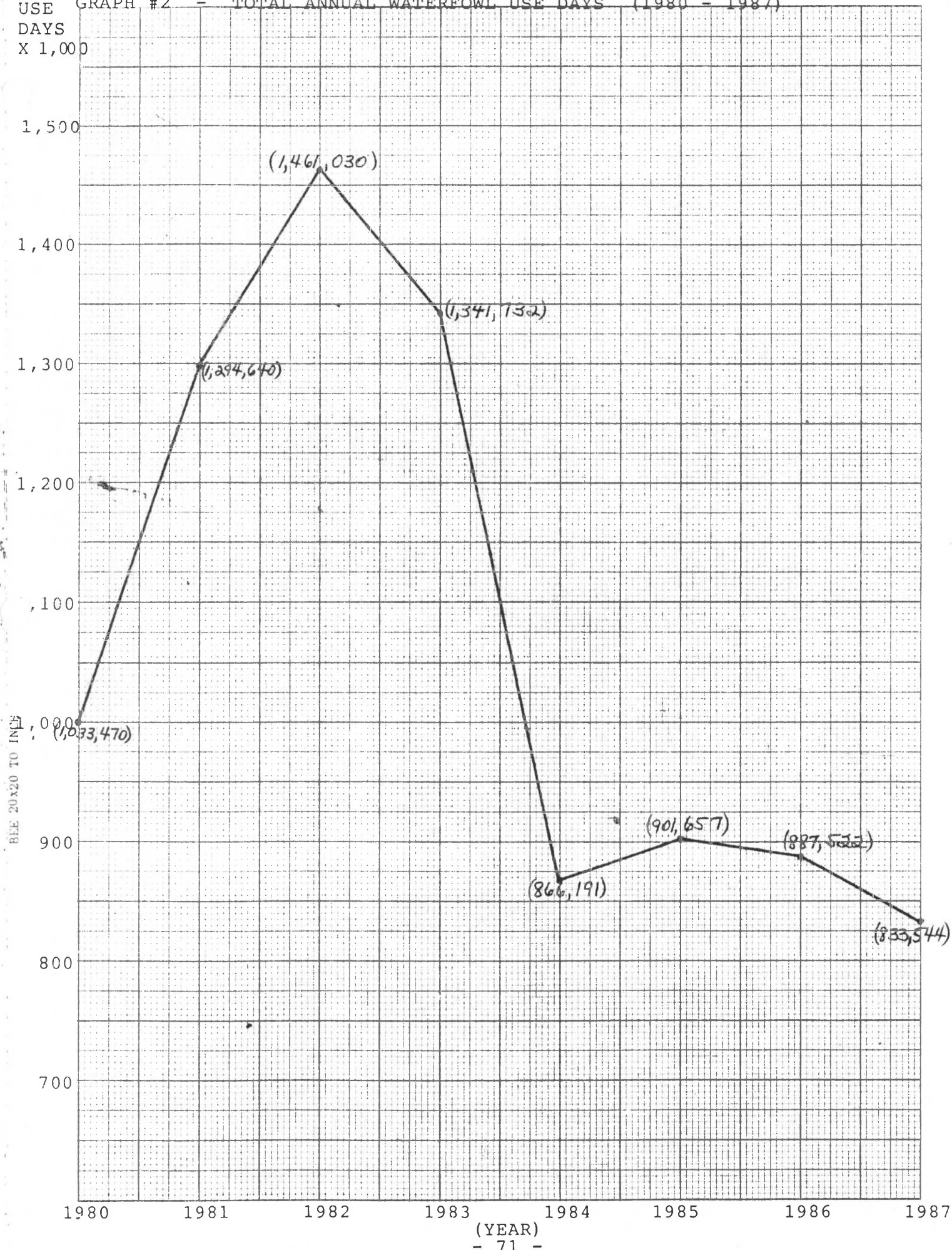
- g. Total Waterfowl Use - The refuge received an estimated total of 827,864 duck-use days; 4,925 goose-use days; and 755 coot-use days during 1987. Table #8 and Graph #2 depict the past several years' use-trends for waterfowl. The trend reflects an overall decline in waterfowl use and numbers, since 1982. There was a change in surveyors at Missisquoi during May of 1984; that might account for some variation, but not the consistently low waterfowl populations of that year and since then. Graph #3 depicts the 1980-1986 annual total of black duck use-days at Missisquoi NWR.

TABLE # 08- ANNUAL PEAK POPULATIONS AND USE DAYS FOR WATERFOWL SPECIES (1982 - 1987)

SPECIES	1982		1983		1984		1985		1986		1987	
	Peak Pop	Use Days	Peak Pop	Use Days	Peak Pop	Use Days	Peak Pop	Use Days	Peak Pop	Use Days	Peak Pop	Use Days
Mallard	9,100	560,035	5,440	462,335	8,700	383,245	5,000	337,070	2,860	165,495	5,180	308,670
Black Duck	4,900	282,615	3,060	254,395	4,100	147,566	3,100	181,180	1,410	81,540	1,600	90,855
Gadwall	325	14,263	275	9,709	100	2,446	430	8,752	40	1,621	50	1,349
Pintail	400	15,354	800	24,877	200	5,340	100	4,527	110	3,686	50	3,035
GWT	400	30,730	250	23,755	300	15,475	525	23,995	310	14,152	800	30,405
BWT	250	14,755	300	19,825	350	16,850	300	14,807	50	3,075	125	5,700
Widgeon	600	29,537	1,000	36,344	300	5,615	750	28,134	310	13,046	110	3,520
Shoveler	50	2,761	35	2,078	50	1,370	40	944	10	306	20	337
Wood Duck	1,500	97,375	1,200	112,356	1,600	110,450	1,300	76,736	920	46,292	1,000	73,320
Ring-necked Duck	8,500	388,526	7,685	356,865	4,000	138,495	4,000	186,224	11,250	536,980	8,000	244,279
Hooded Merganser	75	4,585	75	5,311	50	3,355	125	4,715	50	2,382	90	5,272
American Goldeneye	300	14,005	200	11,897	150	12,996	197	12,815	160	7,817	200	21,440
All Other Ducks	---	4,467	---	9,327	130	4,478	127	11,986	160	7,232	1,895	39,682
TOTAL DUCK USE DAYS	1,459,028		1,329,074		848,131		891,885		883,624		827,864	
TOTAL GOOSE USE DAYS	851		11,743		16,845		8,547		3,538		4,925	
TOTAL COOT USE DAYS	1,151		915		1,215		1,225		360		755	
TOTAL WATERFOWL USE DAYS	1,461,030		1,341,732		866,191		901,657		887,522		833,544	

USE GRAPH #2 - TOTAL ANNUAL WATERFOWL USE DAYS (1980 - 1987)

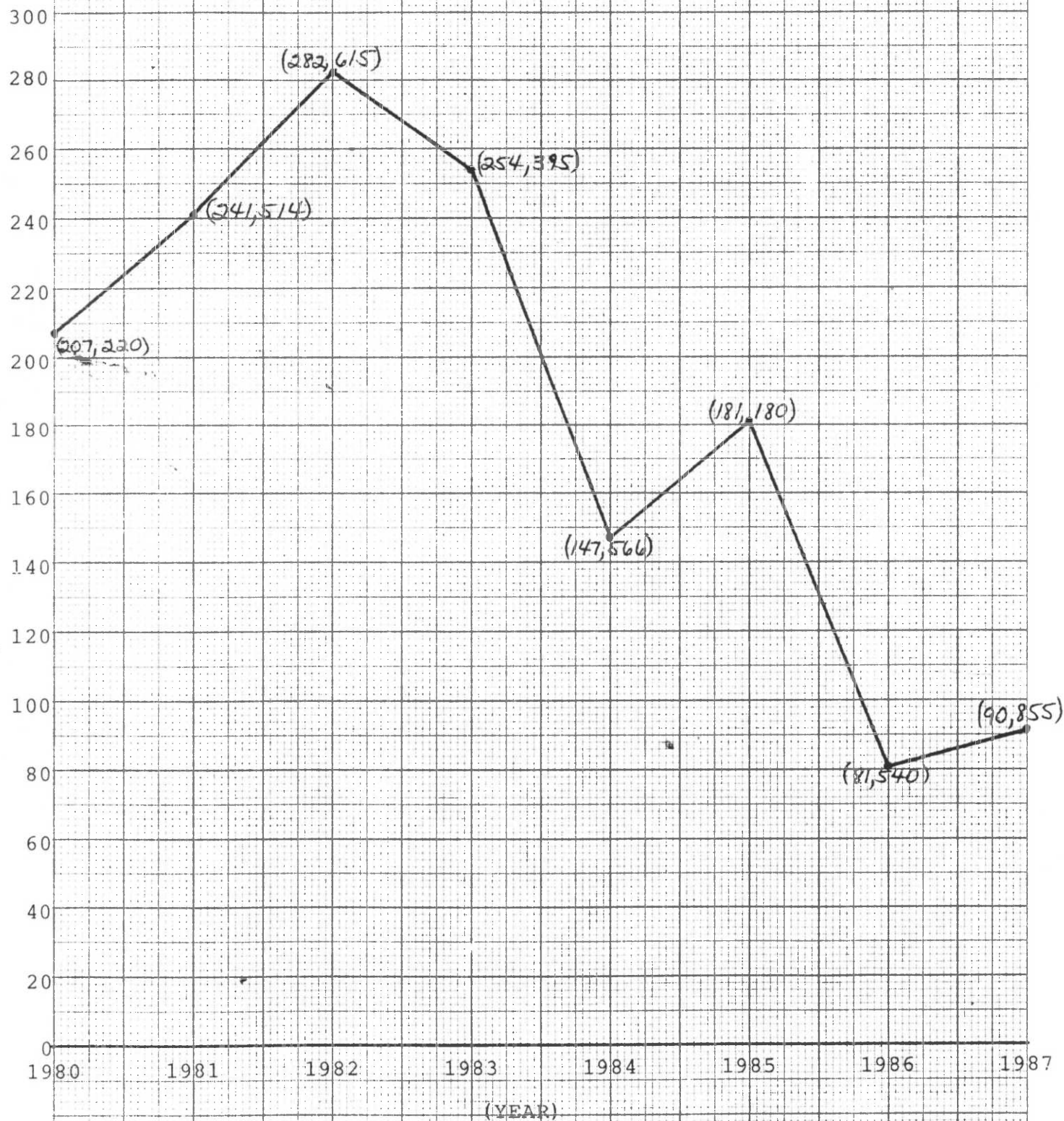
DAYS
X 1,000



GRAPH #3 - TOTAL ANNUAL BLACK DUCK USE DAYS (1980 - 1987)

USE
DAYS
X 1,000

BEE 20x20 TO INCH



4. Marsh and Water Birds

The first local sighting of the great blue heron was on March 18, on the ice near the Mac's Bend boat launch on the Missisquoi River. First sightings during 1983 through 1986 were on March 20, 22, 8 and 19 respectively.

The Shad Island great blue heronry was photographed from the eastern and western sides during February. The prints were later analyzed for a total nest count of only 276 nests. This is 61 nests lower than the 1986 winter nest count, that utilized slides analysis. Either the "slide-counting method" results in a higher nest count, or the "print-counting method" results in a lower nest count, or both. To reconcile the difference, the 1986 and 1987 nest totals were averaged, providing an approximate total of 307 nests within the heronry. During late March and early April, some new nest-building was observed. It was estimated that 1% - 2% of the total 1987 nests were newly built (or 5 new nests), for a total of 312 nests available for use during the 1987 breeding season.

Great blue heron production surveys were conducted during the morning of June 16. Of 84 nests observed, only 3 were empty or unused, for a utilization rate of 96.4% - much higher than in past years. Of those 81 nests occupied, 58 were in full view, with all 190 nestlings visible, for a production estimate of 3.28, or 3.3 young per nest. The number of young per nest was higher than the 1986 estimate of 2.59 young per nest. Of the sample surveyed, most nests contained 3 or 4 young, and three nests contained 5 young. Normally, nests have contained 2 - 3 young, in past years. Estimated production for 1987 was 990 young great blues (301 nests used x 3.3 young/nest) - a peak production year (See Graph #4's comparison with previous years' productions). As in past years, nestling/fledgling mortality was very low, with only 3 - 4 carcasses observed during a walk through the colony grounds after the June 16 survey.

The peak great blue heron population using the Shad Island heronry was estimated to be 1,595 birds. The peak refuge population was estimated to be approximately the same.

Black-crowned night herons continued to utilize night roosts within the Cranberry Pool, Big Marsh Slough and Goose Bay Pool areas during the late summer and fall. Roosts in Big Marsh Slough and Goose Bay Pool are situated in the buttonbush stands along the northern and western sides of the waterways there, while the two Cranberry Pool roosts are located in tall snags next to the Cranberry Dike, and in buttonbush stands just east of Goose Pen Channel. The population peak for these waders was estimated at 50 during August, as in 1986. Numbers of these birds have remained in the 35 - 50 peak vicinity during the past seven years.

GRAPH #4 -- GREAT BLUE HERON PRODUCTION - SHAD ISLAND COLONY - 1980 - 1987

OF
YOUNG
PRODUCED

SEE 20x20 TO INCH

1,000

900

800

700

600

500

400

300

200

100

1980

1981

1982

1983 (YEAR)

1984

1985

1986

1987



The first green-backed heron arrival at Missisquoi Refuge was missed this year. Past first arrivals were observed during mid-April in the Cranberry Pool - Big Marsh Slough areas. The 1987 peak population for this small wader was 35 during August, on a level with 1986, but still lower than those of 1985.

Other marsh and water birds seen and/or heard frequently, include common gallinules (a suspected nester in Big Marsh Slough - but, as yet unconfirmed), Virginia rails, sora rails and pied-billed grebes. The sora rail and pied-billed grebe are confirmed nesters in the Cranberry Pool and Big Marsh Slough-Goose Bay Pool areas. Young of these two species are sometimes seen during the mid-June to early July brood surveys. The Virginia rail has been observed in the Maquam Swamp with young during the same time of year.

Coots are not usually seen until the fall migration, when as many as 50 can be counted along Gander Bay and the lakeshore areas adjacent to the mouths of the Missisquoi River's three branches.

American bitterns are frequently heard calling during April and May in Big Marsh Slough and the Maquam Swamp, where they are suspected to breed. Least bitterns have been observed in the same areas. An estimated 40 American bitterns and ten least bitterns comprised their peak populations during September and July, respectively.

Unusual sightings in this avian group included a great egret (9/2 - Cranberry Dike edge), and several double-crested cormorants (8/12 - Maquam shore).

5. Shorebirds, Gulls, Terns and Allied Species

The first black tern sighting on-refuge occurred on May 5, in Big Marsh Slough. Black tern surveys could only be performed incidentally, with other duties, in suspected breeding areas, due to time and

manpower restrictions. Missisquoi Refuge maintains several small colonies of these unique birds, but their actual size and production is, unfortunately, not yet understood. The colony locations appear to occasionally shift around, however, so that monitoring production requires a specific search and locate survey each year. Production during 1987 was estimated at 35. Breeding has occurred in the past in small areas of Cranberry Pool, Big Marsh Slough, Patrick Marsh and Long Marsh Bay. The peak population of these terns was approximately 100 birds during July, well below the peaks of 1986 (150) and 1985 (200). The refuge population of the black tern appears to be on the decline.

Common tern populations utilizing the refuge vicinities were noticeably lower this year than in the past. This bird is classified as a Vermont State Threatened Species, and usually frequents the refuge lakeshore areas where it perches on snags and boundary signs near the mouths of the three branches and Dead Creek. The peak population for 1987 was 75 during August, in line with the peaks of 1985 and 1986. However, the total number of use-days for the year was noticeably lower (from 2,650 to 2,100). Nesting by this species is not known to occur on-refuge.

The refuge supports a significant common snipe population throughout most of the year. During 1987, this shore-bird was commonly seen during the late afternoons and early evenings of May to August, within Big Marsh Slough, Cranberry Pool and most other wetlands of the refuge. Their calls and "winnowing" flights were common during the last half of May and into June. Refuge populations peaked at approximately 200 birds during late August - below the peak of 250 birds for 1985 and 1986.

Bonaparte's gulls were observed during visits to the Maquam Bay throughout the fall and sitting on the ice during late November and December, with great black-backed and ring-billed gulls. The ring-billed gull is the predominant gull species on-refuge.

Other species using the refuge include increasing populations of spotted sandpipers (suspected nesters along Dead Creek), together with greater yellowlegs, killdeer, solitary sandpipers and semi-palmated sandpipers.

6. Raptors

Information on bald eagles, peregrine falcons and osprey are contained in Section G.2.

The northern harrier, Cooper's hawk and short-eared owl are listed as "Species of Special Concern in Vermont" by the Vermont Fish and Wildlife Department.

American kestrels, red-tailed hawks and northern harriers are the most frequently observed raptors on-refuge during the warmer months. Kestrels are viewed mostly along the Tabor Road hayfields, while red-tails and harriers are observed along the Mac's Bend hayfield and Cranberry Pool vicinities.

Common wintering raptors include the rough-legged hawk, red-tailed hawk, northern harrier, great-horned owl and screech owl. Screech owls utilized waterfowl nest-cans and nest-boxes in Long Marsh Bay and Channel and on Metcalfe Island, as their pellets and small mammal carcasses indicated during January and February.

Snowy owl sightings by refuge staff were more common during 1987 than in past years. Two sightings on the grounds of Missisquoi Valley Union High School in Swanton were reported during mid-February and two "snowies" were seen together in the Patrick Marsh vicinity on March 5. On November 7, a snowy owl was also observed in Shad Island Bay, sitting on a refuge boundary sign.

Less common raptors include the turkey vulture (spring and fall migrations), sharp-shinned hawk, Cooper's hawk, barred and short-eared owls and goshawk.

Surveys specific to this group of migratory birds are not conducted. Survey information is obtained during the course of other surveys and refuge duties.

7. Other Migratory Birds

Common redpolls, mourning doves, pileated woodpeckers, white-breasted nuthatches, tree sparrows, a few pine grosbeaks and black-capped chickadees winter at Missisquoi NWR. Red-winged blackbirds return by the hundreds during late March and April, together with mixed flocks of common grackles, cowbirds, bobolinks and rusty blackbirds. Common crows and robins also begin returning at about the same time, together with song and white-throated sparrows, dark-eyed juncos, tree swallows and bank swallows, belted kingfishers and house finches. Approximately 15 - 20 pairs of bank swallows and 2 pairs of belted kingfishers nested in the sloughed-off bank area of the Missisquoi River, just north of the Dead Creek intersection this year.

First sightings for 1987 in this wildlife category included the following:

Common crow	- 3/11
Starling	- 3/12
Red-winged blackbird	- 3/20
Robin	- 3/24
Cowbird	- 4/13
Yellow-bellied sapsucker	- 4/16
Great-crested flycatcher	- 5/11

Warblers pour into the refuge during the first and second weeks of May, together with great-crested flycatchers, yellow-bellied sapsuckers, kingbirds and smaller flycatchers. All of these early May migrants breed on-refuge in significant numbers. Common warblers include the yellowthroat,

yellow warbler and redstart. Common vireos include the red-eyed, yellow-throated and warbling species. Ruby-throated hummingbirds are occasionally viewed on-refuge during the warm season. On August 21, one was observed by refuge staff feeding on jewelweed on the nesting islands. Prior sightings have occurred in the Cranberry Pool area, also.



Tree swallows were our only takers for the bluebird houses this year. JBG

Catbirds, northern orioles, downy and hairy woodpeckers, veeries, white-breasted nuthatches and brown creepers also frequent the wooded swamps of the refuge throughout the summer and fall.

Four pairs of purple martins nested in the martin house at the refuge headquarters this year. An estimated eight martins were

produced. The martin house was discovered to be in bad shape this year. A new house will be built during the winter.

Pileated woodpeckers are occasionally seen on-refuge throughout the year. They are suspected to nest on-refuge, however, confirmation has yet to be made. Their population averages 5 - 10 individuals, depending on the time of year.

Once freeze-up occurs, 90% of the warm-season passerine residents have already departed until next spring. Flocks of snow buntings and horned larks move into the frozen hayfields along Tabor Road and Mac's Bend Road, when snow cover is limited throughout the winter.

Unusual bird species observed during 1987 include the following: northern shrike (3/6) hovering over a stunned down woodpecker that had struck an office window; hermit thrush pair (5/4); purple finch (4/13); and northern waterthrush (7/15).

8. Game Mammals

The white-tailed deer is the only big-game mammal found at Missisquoi Refuge. The refuge herd is estimated at 35 - 40 deer many of which move on- and off-refuge freely. However, this estimate has no specific data base. Consequently, refuge staff contacted the local Vermont State Deer Biologist (Steve Weber) during November to request his assistance in determining the current deer population on Missisquoi NWR. Subsequent visits and telephone conversations have resulted in selection of a transect-type of deer-trail survey as the population-determinant. Pellet-counts were too time-consuming for our limited staff. The surveys will be conducted during the early fall of 1988 with Steve's assistance and provide us with a better "handle" on our deer herd.

As in past years, the deer herd yarded up in the Maquam Swamp area during the winter. Snow cover seems to be a determinant in whether yarding up will take place in the Maquam Swamp or not. During winters with

little snow cover, the deer seem to remain scattered about refuge interiors (Cranberry Pool, Big Marsh Slough, Maquam Swamp and Long Marsh Channel) and don't seem to "yard." Deer fared well during the winter of 1986-1987, despite good snow cover. Sightings of groups of deer feeding in the refuge hayfields sparks excitement among local hunters during the spring and fall. Summer populations are more dispersed. Deer hunting with bow and arrow, shotgun, and rifle are permitted in some parts of the refuge during the appropriate State seasons. The deer harvest during 1987 was comparable with that of 1986 - both of which are slightly higher than previous years (Ref. Section H. 8).



Missisquoi Whitetail

JBG

Beaver populations are scattered throughout the refuge. Populations within the three trapping units appear to be rebounding after the lows of 1985 - 1986. Beaver trapping was not permitted during 1987 because of the low numbers present, except for nuisance beavers. However, the beaver population along the Missisquoi River and its three branches into Lake Champlain is increasing. Monitoring of those populations began during November and December. Staff began noticing many new houses and bank dens during the summer in that area. The winter beaver house count will include those new areas during early 1988.

The 1987 beaver population survey (via house analyses) was conducted during January 20-22. Zone Biologist Gerry Atwell assisted during the survey. All active and recently inactive houses in the three trapping units were studied. A total of 56 beavers were estimated and broken down as follows:

Unit 1 - 19 beavers

Unit 2 - 12 beavers

Unit 3 - 25 beavers



One of many beaver lodges on the area. JBG

It was estimated that the Cranberry Pool populations would be the only refuge population that could reach a level enabling limited trapping by early 1988. The refuge trapping units are normally closed when the estimated population drops below 30 beavers per unit.

The average number of beaver per active dwelling was estimated at 3.45 during the survey period, slightly below the 3.60 of 1986. Photographs of all beaver houses examined were taken this year and filed with the survey records for future reference.

One or two nuisance beaver(s) continued some work on the Black Creek beaver dam this year, but not on the scale of past years. Flooding of an adjacent landowner's property was avoided this year by routine checks on the dam, and removal of debris when it occurred. At least one nuisance beaver was removed by trappers during the winter season, and this probably diminished the problem. Nuisance trapping permits will continue to be issued to trappers in January of 1988, in this area and adjacent to the Cranberry Pool water control structure (WCS), where damming also occurs.

The muskrat population was estimated at 5,700 during the fall, prior to the trapping season and at 4,500 by late December. Muskrat trapping is permitted within Cranberry Pool, Big Marsh Slough and Goose Bay Pool, to protect the dike systems and wetlands vegetation therein. Local trappers also work the refuge boundaries along the banks of the Missisquoi River, its three branches and Dead Creek, each year and remove many hundreds more with floating trap sets. A muskrat survey was not performed during 1987 due to a lack of time and manpower.

The raccoon population was not as noticeable during 1987, as in past years. The removal of 16 during 1985, and 14 during 1986, from the Cranberry dike waterfowl banding sites by refuge staff, may have thinned them out a bit in those areas. Control measures were not instituted this year on this mammal.

Muskrat trappers reported very limited-to-no losses to raccoons this year. No raccoon hunting or trapping program exists at Missisquoi NWR. Finding the time to verify the refuge population's status through the necessary surveys is not possible with current funding and staffing limitations, although prevalent signs throughout the refuge indicate a moderate population.

Otters are distributed throughout the Wood Duck Creek, Goose Pen Channel, Black and Maquam Creeks, Big Marsh Slough and Goose Bay Pool. Otter trapping is not permitted on-refuge, but occurs in adjacent areas around the refuge. The refuge population was estimated at 50 during December.

The cottontail rabbit is a "Species of Special Concern" in Vermont - indicating that the population is low and/or declining by Vermont Fish and Wildlife Department standards. The refuge population is low and confined to areas within Big Marsh Slough, the hayfields along Tabor Road and the southwestern side of Cranberry Pool. The actual population at present is unknown but is estimated at 50.

The low rabbit population could be accounted for by the diverse predator population that inhabits the same area. Great-horned and barred owls, red-tailed hawks, red foxes, coyotes, etc. are fairly common throughout the refuge. Red fox numbers are highest along Cranberry Dike, the ditches between Goose Bay Pool and Big Marsh Slough, the Big Marsh Slough nesting islands, the western banks of the Missisquoi River and the Black - Maquam Creek higher ground areas. Although population surveys are not conducted, the frequency of sightings of tracks indicates that the refuge population may number 20-25. Their appearances at the banding stations during 1986 required limited control measures that removed three.

The refuge coyote population appears to be on the upswing, judging from the increased sightings and reports from the public during 1987. The refuge was contacted on 3/20 by a local farmer, Mr. Jon Barrette, and a

neighbor, Mr. Timothy Coleman, regarding coyote depredations upon newborn calves on nearby Hog Island, during two previous nights. Refuge staff investigated, since the complaints alleged that the coyotes originated from the refuge. Tracks indicated that at least three coyotes were using the Long Marsh Bay and Channel areas' shrub swamps. No dens were located. One fresh set of tracks was followed by the assistant manager on a snowmobile and the coyote observed before hiding in dense saplings and deadfall east of Long Marsh Bay. A foot search produced nothing. Reports of howling coyotes were also reported during late March and early April by Hog Island residents. In addition, the owners of a restaurant next to the headquarters reported coyotes calling during September evenings, while other passersby reported coyotes crossing the highway onto the refuge at the headquarters area and immediately north during several early mornings of September. An estimated eight coyotes are suspected of using the Maquam Swamp and other areas of the refuge.

Other common mammals utilizing Missisquoi Refuge include woodchucks, red and gray squirrels and weasels. Bobcats, porcupines, fishers and mink are occasional visitors.

10. Other Resident Wildlife

No wild turkey sightings were made or reported during 1987, despite the numerous sightings of 1984 and the 10 - 12 bird flock seen on March 13, 1985, on the Clorith Colgan farm next to the refuge on Tabor Road. The refuge turkey population is estimated at three, below the five birds of 1985 and the fifteen of 1984. Spring and fall turkey hunting is permitted on the lands around the refuge, but not on-refuge.

Gray partridges are known to utilize the fields and woodlands along Tabor Road, Campbell's Bay Road, and the Cranberry Pool dike. Refuge staff observed a group of 14 on August 11, at the refuge parking area in Field #11, adjacent to Tabor Road. Sightings during past years have occurred during the fall, winter and spring, when ground cover is

limited. At the end of CY 1987, the refuge population was estimated at 15 birds, below the 1986 estimate of 20, but on a level with the 15 of 1985.

Ruffed grouse were occasionally encountered by refuge staff during the fall and winter of this year in wooded uplands areas of the refuge. An estimated 25 grouse are year-round residents. Grouse hunting is permitted, but hunter turnout is low to nil.

Common reptiles on-refuge include the northern water snake, the map turtle (Graptemys geographica), eastern painted turtle and eastern spiny soft-shelled turtle (Trionyx spiniferus). The map turtle is classified by the Vermont State Fish and Wildlife Department as a "Species of Special Concern in Vermont," while the spiny soft-shelled turtle is listed as a Threatened Species in Vermont. Refuge staff have been recording spiny soft-shelled turtle sightings since 1984, when Nature Conservancy biologists expressed interest in the nesting and distribution of our disjunct population of this unique reptile. No sightings of this turtle were made during 1987. The refuge turtle population in general was low this year. This lack of "spiny" sightings is in marked contrast to the frequent sightings each year during 1984 - 1986, and merits concern. A closer watch will be maintained for them during 1988. A viable population of these turtles seemed to be present where logs and snags could be found in the three branches of the Missisquoi River. Several sightings of the "spiny" occurred in the Cranberry dike's exterior borrow ditch and in Black Creek during 1986. No nesting sites have been located.

15. Animal Control

The only wildlife species of Missisquoi NWR for which control is currently necessary are muskrat, beaver, woodchuck and raccoon. Muskrats and beavers are managed through a public trapping program, as detailed in Section H. 10. Raccoons and woodchucks are occasionally controlled, but only when the need arises. Such situations occur, in the

case of raccoons, when duck trapping and cannon-netting operations are interfered with significantly, or when trappers' harvests are appreciably diminished. With woodchucks, serious tunnelling within the impoundment dikes that threatens to result in a collapsing of the road surface atop the dike warrants control of the specific pests. Numerous new large holes were discovered along the top of Cranberry dike after a controlled burn during the spring of 1986. In several cases, collapsing of the crown had already occurred and, where muskrat burrows met the woodchuck excavations, the dike slope had also collapsed and eroded. control measures involving use of gas cartridges, resulted in the elimination of approximately 110 active burrows along the northern half of the 2.5 Mile Cranberry dike. The southern half had a considerably lesser density of burrows, with little-to-no negative impacts to the dike. Time and manpower constraints prevented refuge staff from treating the southern half of the dike during 1987. Work will resume in that area during May - June of 1988.

As mentioned in Section G.8., the raccoon problems experienced during past years did not recur in 1987. Thinning out of the Cranberry Pool population via staff removal of 30 raccoons during the last two years may be the reason. No control measures were instituted on raccoons or foxes during 1987.

16. Marking and Banding

The objectives of the 1987 Preseason Banding Program were as follows:

- A. Fill the station's 100 bird wood duck quota with 25 birds of each age and sex included. The quota was exceeded this year.
- B. Fill the station's (new) 100 bird black duck quota. This was not accomplished due to a scarcity of black ducks sprinkled among a preponderance of mallards at this time of year. An increase in black duck populations usually occurs in

October (during the hunting seasons), after our banding program ends.

A total of 649 ducks were banded, of 736 ducks handled and/or trapped (including retraps and escapes). The increased number of ducks banded resulted from the success of the Lily-Pad Trapping Operation and the large numbers of mallards coming to the cannon-net sites with the target black ducks.



Marti Sterin (Manager Al Zelly's wife) on left, Al, and State Game Wardens Swainbank and Lutz assisting in waterfowl banding. JBG

Trapping efforts commenced on August 17th with prebaiting of both the cannon-net site and the Lily-Pad Trap site (in the exterior Cranberry Borrow Ditch). The cannon-net site was mowed and prepared on August 6th by Dan Johnson. The cannon-net was test-fired on August 18th and failed to spread properly. The net anchors and rockets were adjusted and the second shot was successful.



This swim-in trap was very effective in meeting the wood duck banding quota this year. JBG

Tables #9 and #10 depict breakdowns of the Trapping Program for this year. On the first cannon-net shot, the net failed to deploy properly, in that the front skirt flared out in front of the net, allowing 40 - 50 ducks to run out from under the net before it could be secured. Since the net was observed to "snap-back" and hang in mid-air briefly during the shot, suspicion fell upon the rubber (inner-tube strips) shock absorbers. These had been tied into the anchor lines last year to eliminate tearing of the old net at the stress points around the net's leading edge, where the cannon ropes are attached. The "shocks" were subsequently removed and no further problems developed, although further minor tears at the stress points mentioned had to be repaired. A new net was ordered in October.

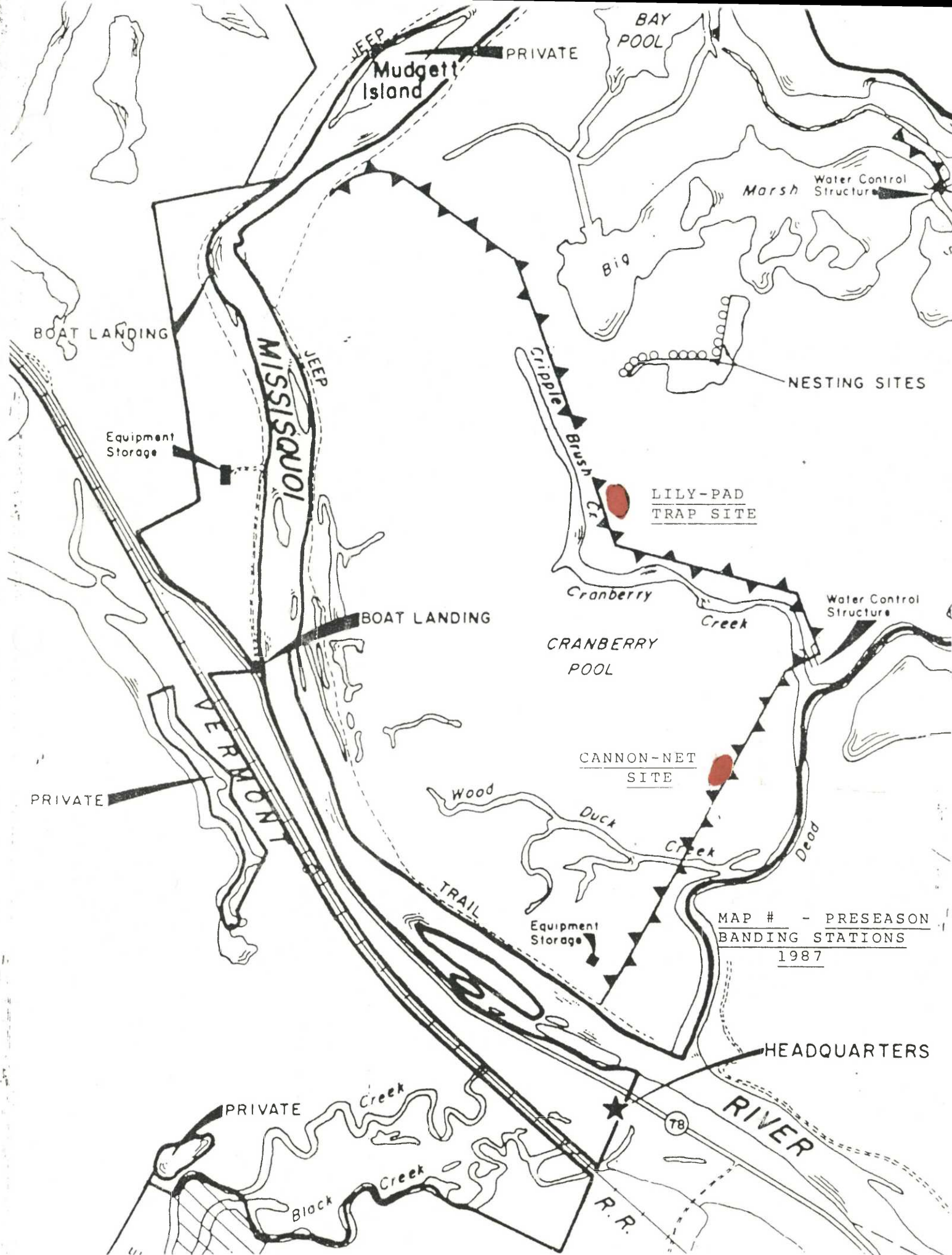
TABLE #9 - CHRONOLOGICAL BREAKDOWN OF 1987 TRAPPING

DATE	TIME	# DUCKS BANDED	# DUCKS TRAPPED	TRAPPING TECHNIQUE
9/2	5:35 PM:	15	15	Cannon-Net
9/4	6:10 AM:	94	100	Cannon-Net
9/4	6:30 PM:	81	82	Lily-Pad Trap
9/10	6:18 AM:	125	149	Cannon-Net
9/11	6:30 PM:	20	28	Lily-Pad Trap
9/16	10:30 AM:	14	18	Lily-Pad Trap
9/16	6:35 PM:	43	58	Lily-Pad Trap
9/17	6:19 PM:	113	123	Cannon-Net
9/23	6:18 AM:	38	40	Cannon-Net
9/25	6:32 PM:	88	100	Cannon-Net
9/30	7:04 AM:	19	23	Cannon-Net
TOTALS		650*	736	

*(Total reflects all ducks banded including one that died after being retrapped, for which the band was taken off of it and reused on a later duck. Thus, the banded total number is one duck higher than the total of Table 10 below, and the banding schedule.)

TABLE #10 - 1985 BREAKDOWN OF DUCKS BANDED

SPECIES	L-M	L-F	HY-M	HY-F	AHY-M	AHY-F	TOTALS
Wood Duck	-	-	51	36	111	34	232
Black Duck	-	-	15	21	5	2	43
Mallard	-	-	84	171	64	47	366
Mallard/ Black Hybrid	-	-	-	2	1	-	3
Pintail	-	-	-	3	-	1	4
Green-winged Teal	-	-	-	1	-	-	1
TOTALS	-	-	150	234	181	84	*649



H. PUBLIC USE

1. General

The "Take Pride" Initiative

January 29, Refuge Manager Zelle and Outdoor Recreation Planner (ORP) Blaskowski attended the Vermont "Take Pride in America" Steering Committee Meeting in Winooski, and took part in the "Take Pride in America" audioconference held at the Soil Conservation Service Office in Burlington.

May 2, ORP Blaskowski attended a "Take Pride in America and Vermont" green-up event at the Ethan Allen Park in Winooski. The Clean-up Crew, an environmental puppetry, mime and dance troupe comprised of high school students from Millburn Township School in Millburn, New Jersey, gave a performance stressing environmental awareness, acid rain, pollution and caretaking of our earth's natural environment.



The State Green-up program ongoing from the early seventies. This mime group was one of many participants. NGB

The Partnerships in Education Scholarship Program's fundraising for the 1987 school year ended on May 17. A total of \$2,300 was raised by raffling artwork donated by local artists.

May 9, the Swanton Girl Scouts worked on flower beds and removing litter from the park they created in downtown Swanton. Evy LaFar, a Highgate resident, donated his time and tiller to turn over an area in the park to be used for wildflower beds.

June 14, ORP Blaskowski presented five \$400 and one \$300 scholarships to graduates of Missisquoi Valley Union High School. These scholarships were the product of the "Partnerships in Education Scholarship Fund" initiated in 1986.

June 8 was a sad day in Swanton, when the longest covered railroad bridge in America (369') was destroyed by fire. The bridge, a Town-Pratt double lattice design, was built in 1898. Over the last six years, the State of Vermont spent \$150,000 restoring the bridge. Missisquoi Refuge, the Swanton Historical Society, Vermont Department of Transportation, Vermont Historic Preservation Division and the Swanton Girl Scouts were working together to create a "Take Pride in America" park in the area across from the South River Road end of the bridge.

The bridge will probably not be replaced. The park was a wonderful "Take Pride in America" initiative and it still may be carried out once all the charred remains are moved.

June 24, Pat Shilling, Girl Scout Leader for Troop 456 of Swanton, received an invitation to attend the "Take Pride in America" ceremony in Washington D.C. The Troop was nominated for an award for their work in creation of a park in downtown Swanton. They were not selected as winners, but were delighted with the invitation; unfortunately, they could not attend the ceremony. During the 1987 school year, 326 students, third-through-eighth grade viewed the "Take Pride in America" slide presentation.

The "Take Pride in America Draw and Tell" sheet, courtesy of C.L. Ferris, Rachel Carson NWR, has proved to be a very popular hand-out to young visitors on the nature trail.

2. Outdoor Classrooms - Students

The 1.5 mile interpreted nature trail was moderately used during 1986 by the local elementary school students. Approximately 376 students toured the nature trail.

3. Outdoor Classrooms - Teachers

March 17, Dr. Daniel Mann of the University of Vermont's Botany Department visited the Maquam Swamp in order to assess its value as an outdoor laboratory. Emphasis would be on the geology, botany and waterfowl value of that area's unique acid-bog ecosystem and the nearby bedrock "islands."

4. Interpretive Foot Trails

The 1.5 mile Black and Maquam Creek Nature Trail is only one of only two self-guided wildlife interpretive trails in Vermont. An estimated 2,054 visitors used this trail in 1987.

7. Other Interpretive Programs

January 9, Assistant Manager Gallegos and ORP Blaskowski presented a slide show on Missisquoi NWR to 15 sixth grade students at the Fairfield Elementary School.

February 10, ORP Blaskowski presented the slide program, "The Unendangered Species" to 120 seventh and eighth grade students at St. Albans Central School.

March 9, ORP Blaskowski presented the slide program, "The Unendangered Species" to 40 fifth grade students at Swanton Central School.

March 11, ORP Blaskowski presented the slide program, "The Unendangered Species" to 20 fifth grade students at the St. Albans Elementary School.

July 1, ORP Blaskowski presented the movie, "Wildlife Babies," to 29 kindergarten children at the Church of the Nativity Bible School.

September 26, approximately 60 persons attended the National Hunting and Fishing Activity Day (NHFD) at Mac's Bend. There were displays of taxidermy, wildlife art, archery demonstrations and a retriever demonstration. Volunteer Chef, Todd Sudol, once again supplied moose and venison jerky, fish chowder and pickled rabbit. Twenty-six youths and eight adults entered the NHFD derby.

October 15, ORP Blaskowski met with eight Swanton Cub Scouts to discuss wildlife management practices on Missisquoi Refuge.

November 24, ORP Blaskowski presented the movie, "Wildlife Babies" to nine residents of the Giordani Care Home in Swanton.

8. Hunting

Waterfowl, other migratory birds, upland game birds, small game and deer are hunted on the refuge. Waterfowl hunting is the most popular hunting activity on-refuge and accounted for 13% of the total visits to the refuge. Most of the hunting activity occurs during the months of October and November.



A hybrid Canada X white front was bagged by a waterfowl hunter just over the border in Quebec. He brought it to us to figure out what he had.

JBG

Waterfowl Hunting

Total waterfowl hunting visits on the Missisquoi Delta were estimated at 992. Actual bag checks of 739 hunters indicated that 988 birds were harvested. Hunter success averaged about 1.34 birds per hunter visit for the season. The overall crippling rate in 1987 was 17%.

The primary species bagged were mallards, 40%; black ducks, 20%; ring-necks, 10%; and wood ducks, 9%.

Saxe's Pothole and Creek and Shad Island Pothole

Hunters averaged .59 birds per hunter visit. The most frequently bagged species were mallards, 53%; black ducks, 25%; and wood ducks, 7%.

Delta Lakeshore Area

Hunters averaged .87 birds per hunter visit. The most frequently bagged species were mallards, 40%, and black ducks, 21%.

Patrick Marsh-Charcoal Creek Controlled Hunt

A total of 158 applications for the 30 preregistered permits were received. The permits were drawn on September 26. There were a total of 60 hunter visits for the season. Hunter success averaged 1.52 birds per hunter. The crippling rate for the hunters using retrievers was 5%, and hunters not using retrievers 9%.

Hunter success for hunters using retrievers averaged 1.47 birds per hunter visit, and hunters without retrievers averaged 1.59.

The most frequently bagged species were mallards, 46%; blacks, 24%; and wood ducks, 17%.

Junior Waterfowl Program

The 1987 waterfowl hunting season marked the eleventh year of Missisquoi Refuge's Junior Waterfowl Program. This Program, designed for youths 12-to-15 years-of-age, has been a cooperative effort by the Refuge, Vermont Department of Fish and Wildlife and the State Chapter of Ducks Unlimited. This program is also heavily supported by volunteers, such as Tiny Brown and Dean Creps, providing the retriever demonstration; Carl Pagel showing use of decoys; and Bill Crenshaw demonstrating goose and duck calling.

A one-day training session was held on September 12. This one-day, mandatory training session consisted of programs about hunter ethics, waterfowl identification, regulations, blind construction, use of decoys, duck calling, shot patterns and use of retrievers.

A brochure was developed to publicize the program. Twenty-two youths participated in the program this year, three more than last year.

A donation of \$75 was received from the State Chapter of Ducks Unlimited which covered most of the cost of a great luncheon that all participants enjoyed. Three refuge volunteers, Mike LaFar, George and Donald Gilbert, helped prepared the chow. George and Donald are veterans of the program.

A total of 54 youth hunter visits resulted in a total bag of 47 birds for an average of .87 birds per hunter visit. The crippling rate was 11%.

Deer Hunting

The archery deer season opened on October 3 and ended October 25. The season was about a week longer than in previous years. No deer are known to have been taken on the refuge during the archery season.

The firearms deer hunting season opened on November 14 and closed November 29. Three deer and, possibly a fourth, were taken on the refuge by hunters during the regular firearms season.

A special muzzleloader deer hunting season ran from December 2 to December 6. No deer were taken on the refuge during the muzzleloader season.

Upland Small Game Hunting

The refuge has areas open to the hunting of rabbit, gray squirrel, and ruffed grouse. Small game hunters are very few, and no game was taken to our knowledge during this season.

9. Fishing

Fishing continues to be a very popular activity along the Missisquoi River and surrounding waters. Fishing accounted for an estimated total of 4,910 visits and 19,640 activity hours of public use in 1987. Lake Champlain and The Missisquoi River provide excellent fishing opportunities for perch, bass, northern pike, walleye, freshwater drum, crappie and bullhead.

Most on-refuge fishing activity occurs along Route 78 near the first boat launching area and at the highway crossing over Charcoal Creek. Fishing also occurs along the Missisquoi Bay shoreline in refuge waters.

10. Trapping

The Refuge Trapping Program during CY 1987 consisted of a January 19 - March 14 nuisance beaver (only) and muskrat trapping season, and a two week (November 9 -22) muskrat trapping season.

Due to the low beaver population in all trapping units only one beaver trapping permit was issued for the removal of nuisance beavers from several houses in the Black Creek headwaters and the exterior Cranberry Pool borrow ditch. Beaver in those houses were plugging up the Cranberry Pool water control structure and damming the upper reaches of Black Creek. All other beaver trapping on-refuge was prohibited this year, to allow their populations to recover. Four nuisance beavers and two muskrats were removed.

During the fall muskrat trapping season, three muskrat trapping permittees harvested a season's total of 467 muskrats from the three trapping units, well above the totals of the last two years. The trappers are selected through a public drawing. A flat fee per trapping unit is charged.

The total annual harvests for beaver and muskrats during the winter and fall seasons is illustrated in Table #11 below, for the period 1977 - 1987.

TABLE 11 - ANNUAL BEAVER AND MUSKRAT TRAPPING

HARVEST AT MISSISQUOI NWR, 1977 - 1987

YEAR (CY)	# BEAVER HARVESTED	# MUSKRAT HARVESTED
1977 - 1978	(Est.) 38	No Trapping
1978 - 1979	54	No Trapping
1979 - 1980	43	216
1980 - 1981	52	255
1981 - 1982	No Trapping	66
1982 - 1983	43	74
1983 - EARLY 1984	No Trapping	No Trapping
LATE 1984	--	523
1985	41	331
1986	18	226
1987	No Trapping* (#4)	469

*Nuisance trapping permitted on 2-3 specific lodges resulted in these removals during the closed season.

12. Other Wildlife Oriented Recreation

The "Blueberry Marsh," the western side of the Maquam Swamp, continues to be a popular spot for a few weeks in July. An estimated 20 visits totaling 60 activity hours were made to the area. The access into the marsh is difficult and, once most of the berries have been picked along the old railroad bed, the visits taper off. Difficult access and the fear of getting lost makes for many unharvested berries.

16. Other Non-wildlife Oriented Recreation

The nature trail, Black and Maquam Creeks provide excellent cross-country skiing areas. An estimated 136 visits, totalling 272 hours, were made to the areas over the months of January, February and March.

17. Law Enforcement

Three cases were submitted via the forfeiture of collateral system for prosecution. The forfeiture of collateral was paid on two of these and prosecution was declined by the U.S. Attorney's Office on the third. These cases were as follows:

Taking migratory game birds during closed season - paid \$200.

Illegal trapping on the refuge - paid \$50.

Hunting waterfowl with an unsigned Federal Migratory Bird Hunting Stamp - prosecution declined.

Warnings were provided for the following.

Possession of an untagged trap	-	1
Nighttime vehicle trespass	-	3
Fishing without a license	-	1
Early shooting	-	1

Cooperation and assistance was also provided by the Vermont State Game Wardens and Special Agent Ed Spoon during the year.

I. EQUIPMENT AND FACILITIES

3. Major Maintenance

Black #2 peastone gravel was spread on the Mac's Bend road. A total of 325 tons of limestone gravel was truck-spread by a local contractor. The limestone cost \$846.88, and the trucking was \$480. The black peastone gravel packs very well as road base.

The Cranberry Pool dike was mowed for the first time since 1984. Due to tree growth and obstructions, the top half of the dike was mowed this year. Now that we have suitable equipment, we hope to continue this maintenance and restore the dike cover to original condition.

A contract was let to Gary Fadden, a local contractor, to replace the roof shingles on the headquarters building. The contract was awarded in early spring, but work could not proceed until the end of the fiscal year due to complications with asbestos removal requirements. The old shingles contained asbestos fibers. The starting date for the contract was delayed awaiting new State regulations that pertain to the handling of this type of material. By the time we gave the contractor the word to start, he was into a busy construction season and did not start the job until the end of the fiscal year.



Old asbestos shingles were replaced this year. JBG

Other work done on the headquarters building included remortaring and repainting the weathered chimney and scraping and repainting the garage doors. The garage doors are almost an annual project since that side of the building gets blasted by the wind and cooked by the sun.



The garage doors were scraped and painted. This is
a time-consuming job. JBG



The finished product - the garage doors will last
a few more years. JBG

A leak was noted in the Cranberry Pool water control structure in May. A band-aid type repair was made by throwing some dirt into the hole. A broken corrugated metal pipe collar had to be repaired on this site about nine years ago to fix a similar type of leak.



A small leak was noticed this year in the Cranberry Pool water control structure. JBG

Old boardwalks which had bridged some seasonally wet areas of the nature trail were removed. These walkway sections were originally constructed in the mid-1970s from old railroad ties. The railroad tie supports had deteriorated to the extent that it was better to take it down than to continue to patch and brace the weak spots. The trail was rerouted in a few places, thereby eliminating the need for some of these short bridges. Some parts of the trail will be muddy during wet weather, but the trail will be accessible most of the year. It is usually underwater in the early spring.



Above photos illustrate why we tore it down rather
than keep patching it. JBG

4. Equipment Utilization and Replacement

Several items of equipment were purchased in fiscal year 1987. Most of these were part of consolidated orders region-wide.

A 20-horsepower, Model 755, four-wheel drive John Deere tractor with a five foot rotary mower was received in July. This equipment will be used for field and dike mowing operations.

A "Delta" 6-Ton equipment trailer was purchased to provide safer transport for our 60-horsepower tractor and brush hog mower to fields along Tabor Road via State Highway 78.

A 4x4 truck utility is on order. This was an end of year wish list item that came through.

Law enforcement equipment was upgraded by the acquisition of two Remington 870 slide-action shotguns with luminous front sights and installation of night sights on the Service revolvers assigned to the Manager and Assistant Manager.

Two Second Chance, Model Y2AW, soft armor vests were purchased for use during enforcement activities.

6. Computer System

A PC's Limited 286 computer, Mitsubishi VDT, and NEC model 8800 Spinwriter printer were delivered in October. The system is also equipped with a telephone modem.

J. OTHER ITEMS

1. Cooperative Programs

As part of the National Bald Eagle Survey, and in cooperation with the Vermont Institute of Natural Science, refuge staff conducted bald eagle surveys in January and March. No eagles were seen on either survey.

On January 6, Assistant Manager Gallegos participated in the Mid-winter Waterfowl Survey for Lake Champlain and Lake George, together with State Fish and Wildlife Pilot Neil King and State Waterfowl Biologist Bill Crenshaw.

Refuge staff assisted Dr. Mann of the University of Vermont's Botany Department in assessing the value of the refuge's Maquam Bog. See "Research and Investigations," Section D.5.

During March, refuge staff assisted Ed Comolli, a refuge neighbor, by maintaining old wood duck boxes and installing five new ones that he provided, on his property along Maquam Creek.

Refuge staff and a volunteer completed the woodcock singing ground counts on 4/24 and 4/30, in Vermont and New York.

The Swanton Chamber of Commerce received permission to install a wooden, "Welcome to Swanton" sign on the headquarters lawn next to Route 78.

3. Items of Interest

January 17, Refuge Manager Zellely attended the quarterly meeting of the Vermont Audubon Council in Montpelier. The Council is promoting bluebird trails throughout its Chapters.

January 29, Refuge Manager Zellely and ORP Blaskowski attended the "Take Pride in America" audioconference held at the Soil Conservation Service Office in Burlington. Representatives from the U.S. Departments of Agriculture and Interior and Vermont State Conservation agencies were present.

February 23 - 27, Tractor Operator Johnson attended the U.S.F.W.S. Basic Fire Management Training program on prescribed burning at Chincoteague NWR in Wallops Island, Virginia.

March 9 - 13, Refuge Manager Zellely attended Law Enforcement Refresher Training at the Eastern Shore of Virginia NWR.

March 26, Assistant Manager Gallegos, Secretary Bluto and ORP Blaskowski attended a Federal Women's Program on male-female interrelationships in the workplace.

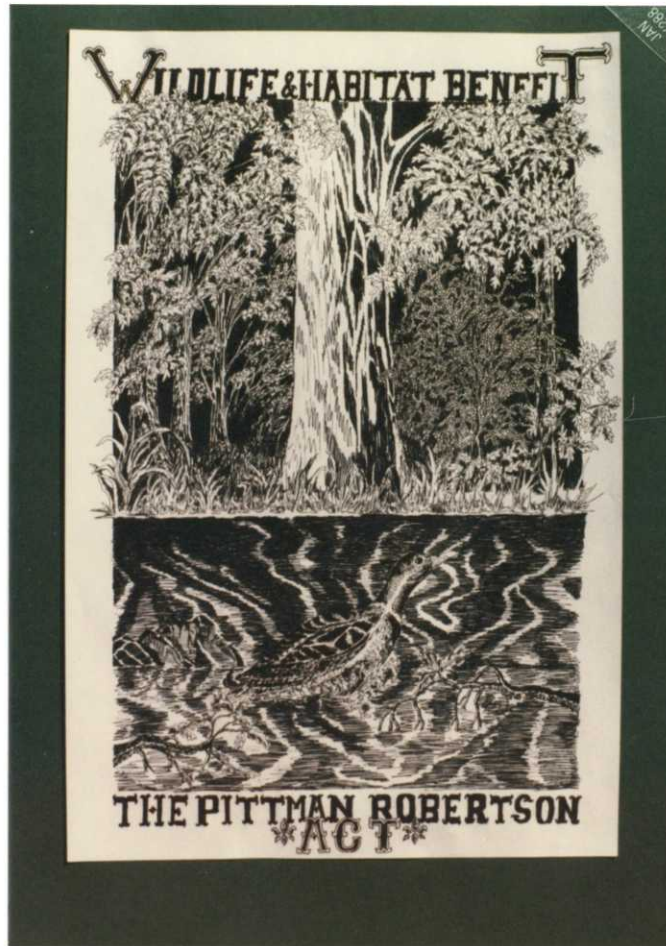
May 11 - 15, Secretary Bluto attended an administrative workshop in Portland, Maine.

May 27, ORP Blaskowski attended a Federal Women's Program hosted by the U.S. Army cold Regions Research Engineering Lab in Hanover, New Hampshire. The program was on improving employment and advancement opportunities for women.

June 3, Manager Zelle presented a Certificate of Appreciation to Mary and Jay Hartman, Senior Class Advisors at Missisquoi Valley Union High School, for their involvement in the refuge-sponsored Partnerships in Education Scholarship Program.

June 14, Manager Zelle attended a steel shot seminar sponsored by the Vermont Department of Fish and Wildlife, and a subsequent (6/16) shooting clinic by Tom Roster.

Three students sponsored by Missisquoi NWR were winners in the 1987 National Hunting and Fishing Day Poster Contest. Eric Beauregard - 7th grade, Laura Dann - 10th grade and Sean Peters - 11th grade won \$50 Honorable Mention Awards. This was the seventh consecutive year Missisquoi Refuge sponsored winners.



One of the Honorable Mention winners of the National
Hunting and Fishing Day Poster Contest JBG

July 24, Refuge Manager Zelle and Assistant Manager Gallegos attended a joint Vermont-New York - Federal Fish and Wildlife Law Enforcement Seminar at Button Bay State Park, Vermont. The day-long session was attended by 25 State and Federal enforcement officers. Special Agent Ed Spoon sponsored the event that dealt with identifying and dealing with fish and wildlife enforcement problems within the Lake Champlain area.

August 4 - 7, Manager Zelle and Assistant Manager Gallegos attended the Project Leaders' Conference at Wells College in Aurora, New York.

October 7, Secretary Bluto and ORP Blaskowski attended a training conference in Highgate Springs sponsored by the Vermont Federal Women's Program. ORP Blaskowski was the principle organizer of the conference that was attended by 93 Federal employees from northern Vermont. Nine guest speakers provided workshops on such subjects as Understanding Job Classification; SF-171 Preparation; Sexual Harassment; Self-Esteem; Wills and Estate Planning; Stress Management; and Juggling One's Home and Career.

October 20, Refuge Manager Zelley, Assistant Manager Gallegos and ORP Blaskowski attended a day-long training session in Burlington on "Working with Difficult People."

On October 20, Homer St. Francis, Chief of the Abenaki Tribe and the Grand Chief from Quebec, Walter Watso, visited the refuge to request a donation of three-to-five acres of land for an ancestral burial ground. No action has been taken on his request.

October 21, Refuge Manager Zelley attended an organizational meeting of the Task Group of State and Federal agencies to participate in drafting the Vermont Outdoor Recreation Plan. This is a document that is required for states to qualify for Land and Water Conservation Fund money.

October 22, an article on the availability of Golden Age Passports ran in the St. Albans Messenger and, as a result, 22 people came to the refuge during November for passports.

November 9 and 11, Manager Zelley, Assistant Manager Gallegos, ORP and Tractor Operator Johnson received baseline hearing tests in accordance with 24AM8.

November 25, Secretary Bluto attended a U.S. Postal Service sponsored Defensive Driving course in Burlington.

December 8, Manager Zelley, Assistant Manager Gallegos and ORP Blaskowski attended a U.S. Postal Service sponsored Defensive Driving course in Burlington.

December 16, Manager Zelley met with Mr. Ron Gonyea, barrier-free consultant, to discuss handicapped accessibility at Missisquoi Refuge. Accessibility was examined for buildings and programs.



Juanita I. Blaskowski, ORP, receives twenty-year certificate service pin from Manager Al Zelley. JBG

December 10, Manager Zelley presented ORP Blaskowski with a pin and certificate for 20 years of Federal service.



Sunrise at Maquam Swamp.

JBG

4. Credits

Manager Robert A. Zelle prepared Sections A, C, D, E.1, E.3, E.5, E.6, E.7, E.8, F.5, F.6, F.7, F.8, F.9., F.10, F.12, H.12, and H.13.

Assistant Manager John B. Gallegos prepared Sections B., F.1, F.2, G., H.10, H.17.

Outdoor Recreation Planner Juanita I. Blaskowski prepared Sections E.4, H.1, H.2, H.3, H.4, H.5, H.6, H.7, H.8, H.9, H.10, H.11, H.12, H.14, J.1 and J.3.

This narrative was edited and typed with WordPerfect on our new computer system by our Secretary Sheila S. Bluto.

K. INFORMATION PACKET - (inside back cover)

HABITAT Highlights



Vermont Fish & Wildlife Department
Wildlife Habitat Improvement Program
Waterbury, VT 05676
244-7331

FALL 1987
VOL. 7, NO. 4

Burlington Intervale "Marsh" Project Dedicated

On Saturday afternoon, June 3, 1987, Vermont's Governor Madeleine Kunin formally dedicated the Burlington Intervale "Marsh" Project before an audience of conservationists and elected officials.

The "Marsh" Project is a cooperative effort between the Department of Fish and Wildlife and Ducks Unlimited (D.U.) that jointly funds and initiates active habitat management at the Intervale marshes. When completed work will include constructing pot holes, level ditching, nesting islands, water control devices, seeding, fencing and nest box erection. These activities will go a long way toward recovering wildlife habitats lost in the construction of the Burlington Northern Connector highway project and are part of a formal habitat mitigation agreement between the Agency of Transportation, Department and the City of Burlington.

The lands are owned by the Vermont Agency of Transportation, managed in perpetuity by the Vermont Fish and Wildlife Department and are primarily for waterfowl production and migrational usage, secondarily for general wildlife usage and public education and recreation. The areas are adjacent to lands owned and administered by the Winooski Valley Park District for conservation and public education purposes.

The Cattail Marsh and Howe Farm wildlife management units were deeded into state ownership in 1985 as mitigation for wetlands displaced in the construction of the Burlington Connector (Route 127) roadway. Also included as part of the mitigation agreement were the construction of a 1,000-foot dike and water control structure at the existing Cattail Marsh site and the



PHOTO: GARLAND

Governor Kunin formally dedicated the Burlington Intervale "Marsh" Project in June, 1987.

creation of 12 waterfowl nesting islands on the newly created Howe Farm wetland unit. Both sites are within the productive Winooski River floodplain, have historical waterfowl usage, and are presently developed to approximately 50% of their estimated waterfowl production and migrational values.

The project will provide for developing the full potential of both areas for waterfowl usage and public education/recreation. Possibilities exist for future acquisition of adjacent lands to expand management capabilities on both areas.

Primary wildlife values are waterfowl and furbearers, particularly mallards, black ducks, wood ducks, blue-winged teal, hooded mergansers, goldeneyes, muskrats and beaver. Other furbearers and a wide range of songbirds, amphibians, and invertebrates live here. The osprey is a frequent visitor to the area and may be encouraged to nest here.

In addition to increasing the production and migrational values of both areas for wildlife, the project will enhance public educational and recreational values. Located

on the northern fringe of the City of Burlington, both sites have high public visibility (Route 127). Overlooks are possible for public use and education. A blend of consumptive and non-consumptive wildlife use values will result in better public awareness of wildlife resource management and the integrated roles of state and private (D.U.) conservation organizations.

Thomas Myers
Wildlife Biologist
Essex Jct.

Marsh and Water Management at Missisquoi NWR

Marsh and Water Management at Missisquoi National Wildlife Refuge occurs on 1,250 of the Refuge's 5,839 acres, referred to as the Goose Bay Pool-Big Marsh Slough (Unit #1) and Cranberry Pool (Unit #2) water management units (WMUs - See Map). Three incomplete dike sections partially impound the two units. Two "gut plugs" form WMU #1. One, an 800' long dike, closes off the drainage flow in Big Marsh Slough. The second "plug," a 2,000' long dike separates Goose Bay Pool from Goose Bay. Water management unit #2 is enclosed along its eastern, lower-elevation half by a 2.8 mile long earthen dike that contains two fully-operable, 4' corrugated metal pipe water control structures (WCSs), immediately west of the Dead Creek intersection.

All WMUs are intended to advance this field station's principal wildlife management objective: to convert lower value wetlands into productive waterfowl habitat. This objective stipulates that water levels in impounded areas will be managed to provide optimum habitat conditions for nesting and migrating waterfowl. To meet these waterfowl objectives, it is necessary to provide as many acres of water as possible, up to a two-foot water depth, with a design that provides for the exclusion of river floodwaters. In addition to increased puddle duck usage, maintenance of such water levels provides for an abundance of such waterfowl food and cover plants as wild rice, arrowheads, wild celery, pondweeds, burreed and buttonbush. Other wildlife (fish, amphibians and mammals) also benefit from this program.

Water management unit #2 (Cranberry Pool) consists of 550 acres. Complete water control is lacking, since 8,400' of diking have yet to be constructed before the unit is completely impounded; however, this unit provides the best management capability once spring floodwaters recede.

The principal water source for the Refuge WMUs are: (1) the spring "melt," and sub-

sequent flooding; and (2) precipitation. Missisquoi River and Lake Champlain waters flood all WMUs during high-water periods (99.25' MSL). All unimpounded Refuge marshes are subject to flooding when adjacent water levels rise above 96.00' MSL.

Draining the Cranberry Pool is dependent upon lower water levels in the Missisquoi River - Lake Champlain system, since this WMU can only be dewatered to the current local water level via the WCS. The spring floodings of the WMUs pose the single most serious obstacle to attaining the 97.00' MSL objective level. Because of the incomplete diking, it is not possible to exclude floodwaters. Therefore, water management of the WMUs is not currently possible until early or mid-May, when the water levels of the surrounding waterways first drop down to 97.00' MSL. *Ideally, the objective level should be reached by or during the beginning of the waterfowl nesting season (early April), in order that a maximum of above-water areas, normally covered by spring floodwaters, be available for puddle-duck nesting.* Extreme spring flooding eliminates the additional puddle duck production and usage that should be occurring within Refuge WMUs throughout the spring and early summer.

From 1982 to 1986, duck production averaged: 166 mallards, 44 black ducks, 14 green-winged teal, 61 blue-winged teal, 360 wood ducks, 215 goldeneyes and 22 hooded mergansers. Ground-nesting, puddle duck production should be higher, especially for mallards and black ducks, since

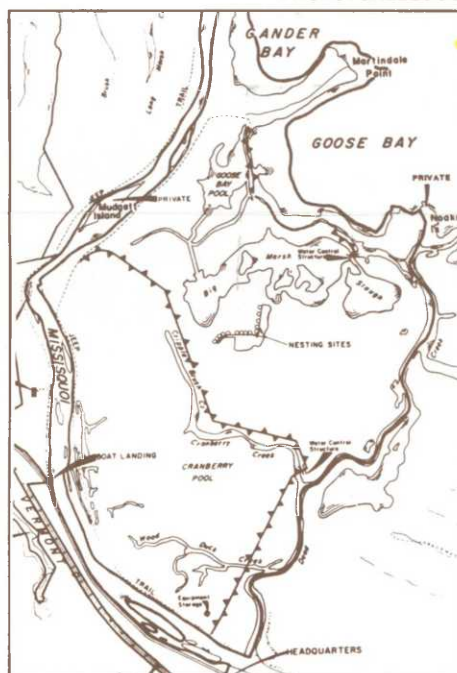
the spring, puddle duck, peak population averaged 1,579 during the same 1982-1986 period, of which 61% were black ducks and mallards.

In addition to the aforementioned water management procedures, the following marsh and water management programs are also performed annually: (1) *Pest Control* -Involving the control of purple loosestrife (*Lythrum salicaria*) and phragmites reed (*Phragmites communis*), along a resident pest of Refuge wetlands, via "RODEO" (Glyphosate) herbicide. Both exotics can eventually out-compete native plants and transform productive wetlands into solid stands of reed and loosestrife. Muskrats and woodchucks must also be controlled along WMU dikes to reduce their tunneling and subsequent erosion of the crown and slopes. Muskrats are trapped, and woodchucks are controlled, with gas cartridges. (2) *Waterfowl Surveys* -Waterfowl population surveys and duck production (breeding pair, brood and nest-box) surveys are performed periodically and measure the effectiveness of current marsh and water management efforts.

Future management possibilities may include completion of the WMU #2 diking and a spring pumping program aimed at bringing WMU #2 water levels down to the objective by mid-April. Both options are intended to increase ground-nesting waterfowl production at Missisquoi National Wildlife Refuge.

John B. Gallegos
Assistant Refuge Manager
Missisquoi National Wildlife Refuge
Swanton

PHOTO: GALLEGOS



Missisquoi NWR
Water Management Units

 = Earthen Dike

What Can I Do For Wildlife?

Buy a Hunting and Fishing License

This is the only source of money available to improve wildlife habitat. Without sufficient financial support nothing will be accomplished. Good intentions and sympathy are not adequate substitutes for action.

Burn Wood

Viable wildlife populations require good habitats. Good habitats require a continuous forest management program including a lot of tree cutting.

Hire a Forester

If you are a landowner you can really help. Hire a forester to manage your woods and tell him or her that you want wildlife habitat improved. If you need help to find a forester call the Agency of Natural Resources District Office nearest you and they will provide a list of consultants to choose from.

The Corps of Engineers—Flood Control Plus A Whole Lot More!

The U.S. Army Corps of Engineers has long been known as an agency that builds dams. Not many people remember that the Corps fought for and carried out the first measures for the preservation of the areas we know as Yellowstone, Yosemite, and Sequoia National Parks. Well, the Corps of Engineers is also a manager of lands—for people and for wildlife.

The Corps has eight dams in Vermont—three “belong” to the New York District and five to the New England Division (NED). When the Corps builds a flood-control dam, they usually have to purchase a number of acres to have a place to store water during a flood. The five NED reservoirs cover approximately 5,700 acres. NED leases about 700 acres to the State of Vermont for management. In its role on the remaining 5,000 acres, the Corps is responsible for many things, including outdoor recreation and fish and wildlife conservation and enhancement. These lands are covered by floodwaters when the need arises, but, for much of the year, the land is there to use—by people and by wildlife.

Hunting, fishing, trapping, bird watching, and wildlife photography are just some of the recreational opportunities available to those who visit these areas.

These lands are also home to many native Vermonters—deer, squirrels, beavers, muskrats, songbirds, ducks, and other fish and wildlife species. Corps personnel have put in motion programs that benefit many of these natives.

Some programs are aimed at improving the quantity and quality of available food, while others enhance the cover needed for breeding, roosting, over-wintering, escaping.

Housing projects are among our more visible projects. Boxes for wood ducks rise above beaver ponds, manmade marshes, and other wetland areas. Smaller boxes for bluebirds and tree swallows line many of our fields. We have even attached bird boxes to our duck boxes with the hope that tree swallows would nest in the smaller, more appropriately sized boxes and leave the larger boxes open for wood ducks to use. The preliminary results are promising as we've had a few instances of tree swallows and wood ducks sharing this type of duplex.

Our housing program for squirrels is less noticeable as these boxes are put up in wooded areas suitable for gray squirrels. Flying squirrels have also taken a liking to some of these available residences.

Much of our forest management is geared toward benefitting one or more species of wildlife. Portions of alder stands are cut periodically to rejuvenate and maintain the stands and to enhance the quality of habitat available for woodcock. Aspen stands are treated in accordance with plans that will lead to better ruffed grouse habitat.

Ruffed grouse, wild turkeys, and many other birds have taken a real liking to our plantings of Japanese barberry, autumn olive, hawthorn, crabapples, and other food-producing shrubs and small trees.

Whitetail deer are on many minds—especially in the fall. We manage mostly for their winter needs. By identifying where they winter at our reservoirs, we can use a little extra caution during a timber harvest in such an area. We can maintain enough cover to keep the area suitable plus manage for some browse to help the deer survive through this tough time of the year.

Areas leased out to local farmers for various agricultural purposes are managed for wildlife through the use of special conditions. Fields of hay cannot be cut before July 15 to allow birds that nest on the ground in those fields to raise their first brood of young and get them off the nest before the mowers come through.

On the watery side, we have tried to stabilize the water level in the pools upstream of the dams to achieve as many wetland and fishery benefits as possible. Muskrats, waterfowl, bass, and beavers tend to do better population-wise when the water level doesn't bounce up and down. Of course, floods are the monkey wrenches for this program, but floods are why the dams are there in the first place.

We've placed current deflectors to narrow down a river's channel. The deflectors are made from logs or wire baskets (gabions) and are filled with stones. These deflectors have made some nice-looking pools for trout.

Some of our lakes are lacking in cover for warmwater fish like largemouth bass. So, by bolting some old tires together and placing them in these lakes, we can create an artificial reef that will attract fish from fingerling to lunker size.

We have other programs that benefit many wildlife species. We also offer other recreational opportunities (swimming, picnicking, camping) for people to enjoy. Take some time to stop by one of these days, and see what the Corps has to offer besides dams.

Gary Pelton
Park Ranger
Corps of Engineers
Springfield

Wildlife Habitat Management on the Green Mountain National Forest

The Green Mountain National Forest (GMNF) contains 325,000 acres of wildlife habitat. These habitats provide living space for over 300 species of vertebrates. Some species such as the white-tailed deer utilize almost all of the habitat types the Forest provides. Others such as the bluebird are tied to a specific habitat type, in this case old fields and orchards, and are seldom found outside the preferred type.

The GMNF has vegetation objectives to provide a mixture of forest types (northern hardwood, softwood, aspen, oak, and upland openings) and a variety of age classes distributed across the Forest. These objectives are designed to provide habitats for all wildlife. Some species such as deer and grouse have habitat requirements which represent the needs of many other species. By providing habitats for the deer and grouse, which we call management indicator species, all other vertebrates are assured a home.

There are two types of habitat management approaches on the GMNF. The wildlife habitat improvement program does things like create and maintain old field habitats called upland openings and improving wetlands. We also install structures like nest boxes for wood ducks and bluebirds. The other major habitat effort is accomplished through our timber sales program. All timber sales are coordinated and designed with the needs of wildlife in mind.

Timber sales create new habitats by changing the age and sometimes the vegetative type of the stand. A good example of changing type is when we convert a hardwood stand to a conifer stand for future winter deer cover. Cutting down mature stands of trees provides habitat for grouse, woodcock, chestnut-sided warblers and many other grass and shrub dependent species. Timber sales allow us to plan and control the habitat quantity and quality as well as disperse habitats around the Forest in a cost effective manner. Without commercial timber sales there would be no reasonable way to manipulate wildlife populations.

The following is the approximate annual program on the Forest for wildlife habitat improvement:

-We maintain 500-600 acres of upland openings by prescribed burning with a few acres being mowed. These openings provide habitat for almost half of the animals on the Forest as well as campsites, berry picking and good visual experiences. Less than

2% of the Forest is in this habitat type but we will be increasing this to 3-5% in the future.

- Constructing 40 acres of openings to increase this habitat type.

- Maintaining 30 acres of wetlands through controlled burning to keep grass and sedges productive for waterfowl and furbearers.

- Maintain 100 nest boxes for waterfowl and bluebirds. We check for nesting success, clean, repair, and replace fresh nesting materials in each box.

- Release (hack) 12 peregrine falcons each year in cooperation with the Peregrine Fund and Vermont Fish and Wildlife Department.

- Prune 20 acres of apple trees to increase fruit production.

- Burn 10 acres of blueberry areas to increase fruit production for wildlife and human consumption.

- Control access to areas of the Forest so black bear habitat remoteness is maintained.

Coordinate with the timber sales program on the design and layout of commercial timber sales. The Forest is 83% northern hardwood (beech, birch, sugar and red maple) mostly 60-100 years old. We are designing sales to increase the variety of tree types and age class distribution for wildlife benefits as well as tree health.

- Coordinate with Vermont Fish and Wildlife Department on management of deer wintering areas, black bears, turkey and the Atlantic Salmon.

All these activities are carried out so that wildlife may be enjoyed by the public. The recently completed Forest Plan for the GMNF has outlined the wildlife program for the next decade. The plan is a result of many years efforts with the public and other State and Federal agencies. We trust the wildlife on the Green Mountain National Forest will be more abundant and available to our publics in the years to come because of these ongoing efforts.

Jim Denoncour
Wildlife Biologist
Green Mt. National Forest
Rutland

AGENCY OF NATURAL RESOURCES

Dept. of Forests, Parks & Recreation
Dept. of Fish & Wildlife Offices

DISTRICT I
(Windham, Windsor Counties)
RR #1, Box 33
North Springfield, VT 05150
886-2215

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(Bennington, Rutland Counties)
Pittsford Academy
RD #1
Pittsford, VT 05763
483-2300

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Barre District Court Building
255 No. Main Street
Barre, VT 05641
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Editor: Lawrence Garland



HABITAT Highlights

Agency of Environmental Conservation
Vermont Fish & Wildlife Dept.
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103 South Main St.
Waterbury, VT 05676

FIRST CLASS

Mammals

of
Missisquoi
National
Wildlife
Refuge



Vermont

Missisquoi National Wildlife Refuge is approximately 50 miles north of Burlington in Franklin County, Vermont. It is located on the eastern shore of Lake Champlain near the Canadian border with the headquarters on Highway 78, two miles northwest of Swanton.

The refuge encompasses 5,839 acres, a little over 95 percent of the 6,000-acre Missisquoi River delta. About one-third of the area is swamp dominated by silver maple. The woodlands also contain red maple, American elm, white ash, and white oak. Bulrush, wild rice, sedge, spikerush, burreed, and pickerelweed are the most common marsh plants, but many shrubs, such as willow, alder, sweet gale, hardhack, and buttonbush grow where the water is shallowest.

Although the refuge was established primarily for waterfowl, many species of mammals are present. Among the most readily observed are white-tailed deer, muskrat, raccoon, and red and gray squirrels. Some, because of their size or habits, are less likely to be seen.

The following list of 34 mammals has been prepared by refuge personnel from observations made over the years. The hypothetical listing of bats based on reported range was submitted by Dr. Robert Fuller, University of Vermont.



Muskrat

Shorttail Shrew

(*Blarina brevicauda*)

Common over most of the refuge. Digs tunnels and uses burrows of other species, especially voles. Feeds mainly on insects, plants, worms, snails, and small vertebrates.

Starnose Mole

(*Condylura cristata*)

Found throughout the area in damp meadows and woods with moist soils. An excellent swimmer, its diet consists of aquatic insects, earthworms, crustaceans, snails, small fish, and small amounts of vegetable material. Their eyesight is poor and the projections on its nose are sensitive feelers, helping it locate its prey.

Bats

This list is based on reported ranges. The following probably occur on Missisquoi National Wildlife Refuge.

- | | |
|---------------------|--------------------------------------|
| Little Brown Myotis | (<i>Myotis lucifugus</i>) |
| Big Brown Bat | (<i>Eptesicus fuscus</i>) |
| Keen's Myotis | (<i>Myotis keenii</i>) |
| Small-footed Myotis | (<i>Myotis leibii</i>) |
| Silver-haired Bat | (<i>Lasionycteris noctivagans</i>) |
| Red Bat | (<i>Lasiurus borealis</i>) |
| Hoary Bat | (<i>Lasiurus cinereus</i>) |
| Eastern Pipistrelle | (<i>Pipistrellus subflavus</i>) |

New England Cottontail

(*Sylvilagus transitionalis*)

Present in small numbers in brushy and second growth hardwoods on the mainland portion of the refuge. Their summer diet consists of grasses and herbs and their winter diet consists of seedlings, bark, twigs, and buds. Rabbits bear naked, blind young.

Snowshoe Hare

(*Lepus americanus*)

Present in small numbers in brushy and second growth hardwood stands on the mainland portion of the refuge. Feeds mainly at twilight and evenings; in summer on clover, grasses, and ferns; in winter on twigs, buds, and the bark of small trees and seedlings. Young are born with dense fur and open eyes.

Eastern Chipmunk

(*Tamias striatus*)

Present in small numbers in the drier woodlands that have dense undergrowth. Feeds on seeds, nuts, fruits, bulbs, and insects.

Gray Squirrel

(*Sciurus carolinensis*)

In small numbers where there is mast-producing timber. Tall trees are used for dens or leaf nests. Their diet consists of nuts, buds, seeds, grains, fungi, fruits, bird eggs, and inner bark of trees.

Red Squirrel

(*Tamiasciurus hudsonicus*)

Found throughout most wooded areas but not common. Prefers to nest in natural cavity or abandoned woodpecker hole. They may construct globular leaf nests near top of tree or use ground burrows. They prefer a conifer woodland because their diet is partially made up of seeds of conifer cones. They also eat nuts, buds, fruits, sap, flowers, fungi, bird eggs, and nestlings. They are an important food source for hawks and owls.

Northern Flying Squirrel

(*Glaucomys sabrinus*)

Present throughout wooded portions. Favors cool, heavily wooded conifer and deciduous forests. Summer nest may be on a limb next to a tree trunk and winter nest is in a cavity. They often use old woodpecker holes. They eat nuts, seeds, catkins, fruits, buds, insects, mushrooms, bird eggs, and nestlings.

Woodchuck

(*Marmota monax*)

Very common in and around open fields and agricultural lands. Digs extensive systems of burrows including hibernation and nest chambers. Prefers green vegetation such as herbs and grasses.

Beaver

(*Castor canadensis*)

Common along streams bordering and coursing through the refuge. Beaver are most often observed during evening hours along the Missisquoi River, Dead Creek, and the Black and Maquam Creek Trail. Beaver build dams to flood areas where they feed and construct lodges. The water areas created by beaver dams benefit waterfowl, marsh birds, and other mammals. The den is enclosed in a large lodge made of mud and sticks and is used for raising young and providing winter shelter. Burrows dug in banks are also used as dens. The beaver consumes bark of deciduous trees and is particularly fond of swamp white oak and birch. Food is stored under the ice for winter use.

White-footed Mouse

(*Peromyscus leucopus*)

Common over much of the refuge. They feed on seeds, acorns, nuts, fruits, tender green plants, insects, and small amounts of carrion.

Meadow Vole

(*Microtus pennsylvanicus*)

Very common in the meadows and fields. Diet consists of grasses, bulbs, seeds, grains, and small amounts of carrion. Nests in sheltered areas under rocks and logs and builds extensive tunnel systems. Females are very prolific, capable of producing a hundred young within a year. They are an important food source for birds of prey and small carnivorous mammals.

Muskrat

(*Ondatra zibethicus*)

Seen frequently in all water areas. The muskrat uses cattails, burreed, arrowhead, wild rice, cutgrass, bulrushes, pondweeds, water lilies, and other marsh plants for food and houses, creating openings in the dense marsh vegetation. The openings provide habitat for waterfowl. Ducks and geese use the muskrat houses for nesting sites. Muskrats are mainly nocturnal, but may be seen in daylight. They are active throughout the year.

Norway

Rat

(*Rattus norvegicus*)

Present mainly along Missisquoi River, but occasionally found in marshes. They are omnivorous and will consume fruits, grains, vegetables, carrion and fresh meats, and garbage.

Porcupine

(*Erethizon dorsatum*)

The few porcupines present are confined to an area in the West Swanton section of the refuge where there are small, scattered hemlock stands. Den sites are in protected places such as rock ledges, trees, and abandoned fox or beaver dens. They eat herbaceous and woody vegetation, grasses, leaves, twigs, mast and bark.

Coyote

(*Canis latrans*)

A few present but seldom seen. Have been seen along Tabor Road. Den is usually in an excavated burrow, well hidden by vegetation or rock. They are omnivorous and will consume carrion, small mammals, and vegetation.

Red Fox

(*Vulpes vulpes*)

Not numerous but may be seen occasionally over most of the refuge except where limited by water. Prefers to use existing burrows for rearing young and escaping from predators, but will dig dens. Preys mainly on small mammals and birds, insects, carrion, and fruits.

Raccoon

(*Procyon lotor*)

Common throughout the refuge. Dens are usually located in trees but culverts, abandoned woodchuck burrows, and other protected areas are also used. They are omnivorous and will consume fruits, insects, crayfish, buds, seeds, grass, and garbage. Primarily nocturnal but may be seen in daylight.

Fisher

(*Martes pennanti*)

An occasional visitor. Dens in hollow trees, logs, or abandoned porcupine dens. Fishers are one of the few predators that prey on porcupines. Shrews, mice, squirrels, toads, berries, nuts, and carrion are also included in their diet.

Shorttail Weasel

(*Mustela erminea*)

Present in small numbers in wooded areas. Eats mice, chipmunks, moles, shrews, and occasionally birds and insects. Molts to white in winter.

Longtail Weasel

(*Mustela frenata*)

Present in small numbers in drier sections. Dens in natural holes or crevices or excavated burrows. Feeds primarily on small mammals, ground nesting birds, and insects.

Mink

(*Mustela vison*)

Present but not numerous. Favors forested wetlands. Dens inside hollow logs, natural cavities under tree roots, or in burrows along streams. They are excellent swimmers and prey on both aquatic and terrestrial animals, including muskrats, fish, rabbits, and snakes.

Striped Skunk

(*Mephitis mephitis*)

Occasionally seen on drier areas of the refuge. Dens may be in abandoned burrows, stone walls, rock crevices, and stumps. The diet of the skunk includes small rodents, bird eggs, fruits, grains, nuts, grasses, berries, insects, garbage, and carrion.

River Otter

(*Lutra canadensis*)

Frequently seen in the Missisquoi River, Maquam Creek, and Charcoal Creek. Den may be in an abandoned beaver lodge or muskrat house, dense thickets bordering water, or under fallen trees. Diet consists of fish, frogs, turtles, snakes, and birds.

Bobcat

(*Lynx rufus*)

An occasional visitor. Prefers to den in rock crevices, under fallen trees, or in hollow logs. Most prey is taken by stalking. Diet consists of small mammals such as snowshoe hares, cottontails, squirrels, mice, voles, birds and their eggs, snakes, fish, insects, and some vegetation. Will also eat dead animals if the meat is fresh.

White-tailed

Deer

(*Odocoileus virginianus*)

Frequently seen over entire refuge. Preferred habitat is forest edges, swamp borders, areas interspersed with fields, and woodland openings. Deer browse on woody deciduous plants, twigs, and young bark. They graze on grasses, herbs, berries, and mushrooms.

Reports of additional species will be welcomed.
Please contact:

Refuge Manager

Missisquoi National Wildlife Refuge
RFD #1

Swanton, Vermont 05488

Telephone: (802) 868-4781

Illustrations by Julien D. Beauregard
Swanton, Vermont



United States
Department of the Interior
Fish and Wildlife Service



Missisquoi

NATIONAL WILDLIFE REFUGE

A great variety of fish abound in the waters in and surrounding the Missisquoi refuge. Walleye, northern pike, bullhead, and yellow perch are the most sought after fish on the delta. Other species caught are: burbot, carp, catfish, bowfin, white and redhorse suckers, American eels, chain pickerel, muskellunge, sheepshead, crappie, gar, pumpkinseed, smallmouth bass, largemouth bass, rock bass and landlocked Atlantic salmon.

The use of firearms to take fish is prohibited. For current regulations, contact the Refuge Manager, Missisquoi National Wildlife Refuge, Swanton, Vermont 05488, (802) 868-4781.

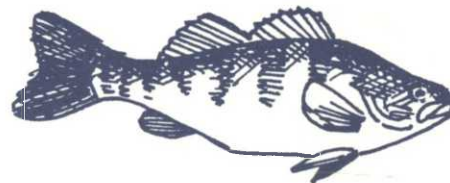
Vermont Annual Record and State Record Fish forms are available at Refuge Headquarters, local bait shops, and from the Vermont Fish and Wildlife Department, I&E Section, Montpelier, Vermont 05602.

Consult the Vermont Fish and Wildlife regulations for seasons and limits.

While fishing in lakeshore areas you may notice numerous metal and wooden boxes. These boxes provide nesting sites on the refuge for waterfowl. Waterfowl require solitude and seclusion to successfully hatch their eggs. To minimize nest abandonment, sportsmen should try to maintain a distance of approximately 75 yards or more from nest boxes.

Fishing Record

DATE _____ TIME _____
 AIR TEMPERATURE _____
 WATER TEMPERATURE _____
 CLOUD COVER _____
 WIND _____
 CATCH _____



Yellow Perch

The cover drawing, a largemouth, was contributed by artist Julien Beauregard.

For more fish information contact:
 Refuge Manager
 Missisquoi National Wildlife Refuge
 Swanton, VT 05488
 or the
 Vermont Fish and Wildlife Department,
 Montpelier, VT 05602.



United States
 Department of the Interior
 Fish and Wildlife Service

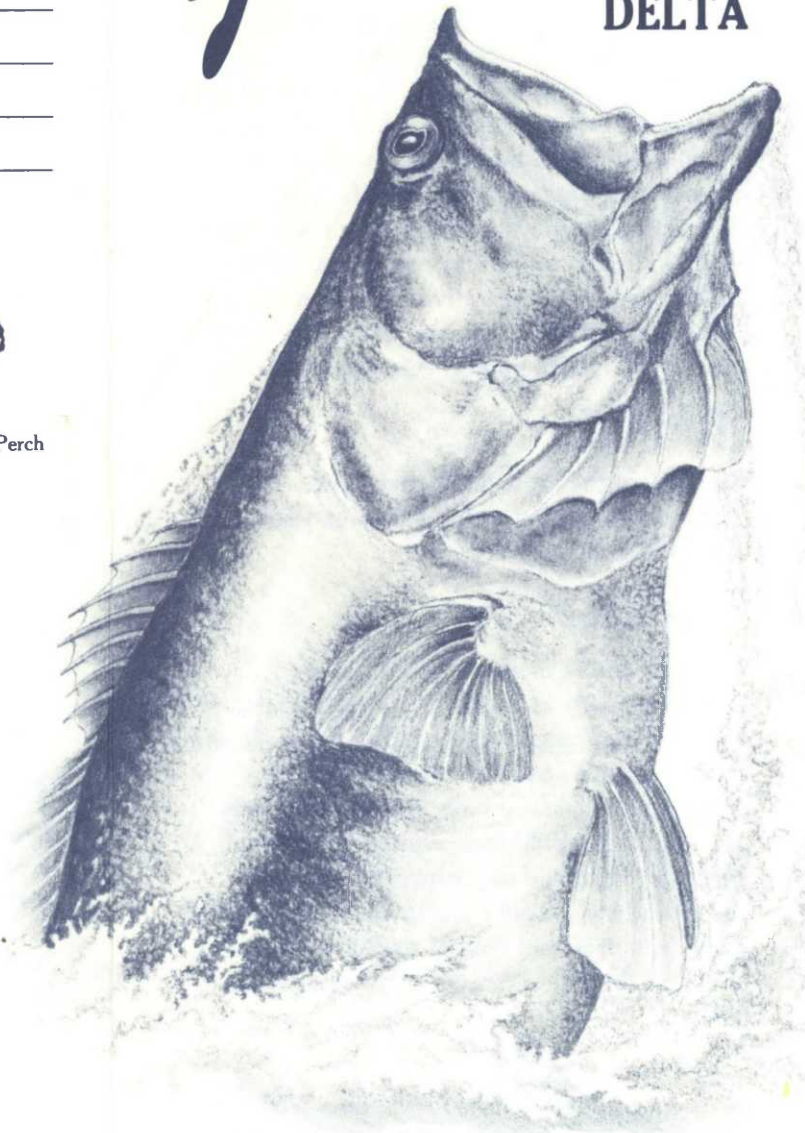


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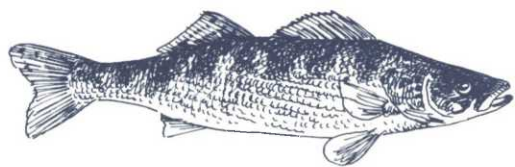
September 1985

Fishing

ON THE MISSISQUOI DELTA



MISSISQUOI
 National Wildlife Refuge
 Vermont



Walleye

Walleye

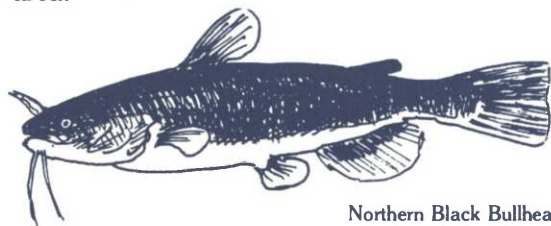
Walleye, while closely related to yellow perch, grow much larger and are much sought after by fishermen. Suggested baits are minnows, mayfly larvae, hellgrammites, bucktail jigs trailing a pork rind, plastic worms, or nightcrawlers. Work the jigs slow and deep. As a general rule, you'll find most walleye over sandy, rocky or gravel bottoms. In the Missisquoi River, try below the Swanton Dam, in rapids, and alongside eddies in the spring. The deep water along undercut banks and pools is also a good location. Walleye are active night feeders, often feeding in shallow water near shore; thus, evening ice fishing can be very productive.

Catfish

Night fishing is most productive. Use earthworms, minnows, leeches, bread balls, or chunks of beef or liver.

Bullhead

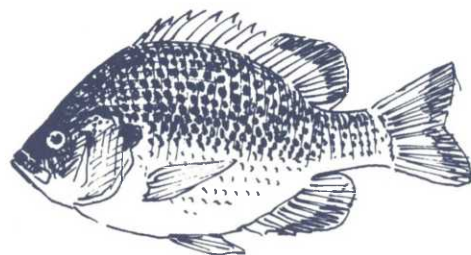
The bullhead is mainly a bottom feeder, foraging mostly at night. It is omnivorous and a notorious scavenger with crayfish the preferred food. Minnows, crayfish, corn kernels, hellgrammites, bread balls and nightcrawlers are good bait. Bullheads usually bite best at night or during the day when the water is muddy after a heavy rain. Because of its good eating qualities and lack of excessive bones, it is one of the prime targets of fishermen in the area.



Northern Black Bullhead

Muskellunge

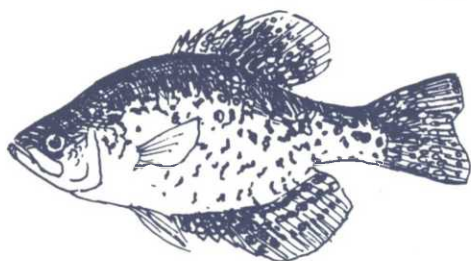
Underwater vegetation beds, points of land, or islands which extend into the water are good spots to fish for muskellunge. Spoons and plugs up to 7 or 8 inches will attract these big fish.



Pumpkinseed Sunfish

Pumpkinseed

These panfish prefer quiet shallow waters. Bread balls, worms, small lures, flies, and minnows are suggested baits.



Black Crappie

Crappie

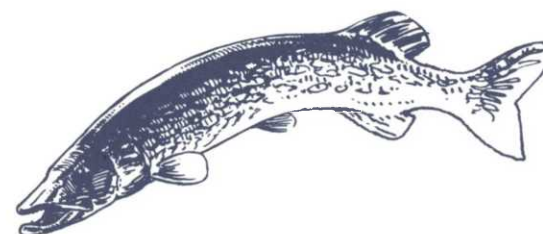
Crappie are often found in weed beds and around sunken brush and trees. Preferred baits are minnows, flies, jigs or spinners.

Salmon

An excellent place to fish for landlocked salmon in the spring and fall is in the Missisquoi River. Landlocked salmon strike more often on windy, cloudy days. Commonly used baits consist of salmon eggs, minnows, and flashy red lures. Bits of sponge can be substituted for salmon eggs.

Northern Pike

Pike are one of the more popular sport fish in the area. Prime fishing spots are coves with aquatic vegetation, edges of lily pads, shorelines with many fallen trees and driftwood, and sudden drop-offs from shallow weed beds. In the river, deep still pools, eddies, backwaters, and shorelines with cover such as weeds and overhanging branches are favored haunts. Suggested baits are large minnows, weedless silver spoons with pork rind, red-eye wigglers, or red and white spoons.



Northern Pike

Carp

Soft-shelled crayfish, bread balls, and whole kernel corn are good baits. It is best to fish for carp early in the morning or in the evening.

Bass

Smallmouth bass are frequently found in rocky areas. Largemouth bass prefer weed beds, sunken trees, logs, and snags. Nightcrawlers, minnows, frogs, crayfish, surface poppers, and rubber or plastic worms are good baits.

Yellow Perch

Many perch are caught in Lake Champlain and in the slower moving sections of the Missisquoi River. Mayfly larvae or a small spinner with a strip of pork or a worm on the hook are good baits. Ice fishing for perch is usually better towards evening.

Please report any unusual sightings to the Refuge Manager.

For further information contact:

Refuge Manager

Missisquoi National Wildlife Refuge

RFD #2

Swanton, Vermont 05488

Telephone: (802) 868-4781

Office Hours: M-F 8:00 a.m. - 4:30 p.m.

NOTES

Location _____

Date _____ Total _____

Observers _____

Weather _____ Wind _____

Time _____



**UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**



JUNE 1983

RL 53520-2

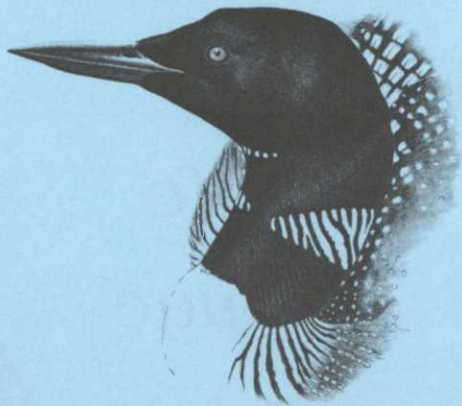
BIRDS of Missisquoi National Wildlife Refuge



Vermont

Welcome to the Missisquoi National Wildlife Refuge. This leaflet lists 199 species of birds that have been identified on Missisquoi National Wildlife Refuge since its establishment in 1943.

This list was prepared in cooperation with Judy Clair, Ruth Nissen of Swanton, Vermont and Dr. H. Shadowen, Biology Department, Western Kentucky University, and was illustrated by Julien Beauregard, Swanton, Vermont. This list is in accordance with the Sixth A.O.U. Check-list.



Most birds are migratory, therefore their seasonal occurrence is coded as follows:

SEASON

s - Spring	March - May
S - Summer	June - August
F - Fall	September - November
W - Winter	December - February

† - Nesting has occurred on the refuge.

RELATIVE ABUNDANCE

a - abundant	a species which is very numerous.
c - common	certain to be seen or heard in suitable habitat
u - uncommon	present, but not certain to be seen.
o - occasional	seen only a few times during a season.
r - rare	seen at intervals of 2 to 5 years.

LOONS - GREBES - CORMORANTS

Common Loon	o	o	o
Pied-billed Grebe†	u	c	u
Horned Grebe	o	o	o
Red-necked Grebe	o	o	
Double-crested Cormorant	o	o	o

BITTERNS - HERONS

American Bittern†	c	c	o
Least Bittern†	r	u	
Great Blue Heron†	c	c	r
Great Egret	r	r	
Green-backed Heron	u	c	o
Black-crowned Night-Heroh	o	c	o

GEESE - DUCKS

Snow Goose	u	u	
Brant	r	r	
Canada Goose	o	o	c
Wood Duck†	a	a	a
Green-winged Teal†	c	o	c
American Black Duck†	a	a	a
Mallard†	a	a	a
Northern Pintail	c	o	c
Blue-winged Teal†	c	c	o
Northern Shoveler	c	o	c
Gadwall	o	o	c
American Wigeon	o	o	c
Canvasback	o	c	
Redhead		o	
Ring-necked Duck	c	o	c
Greater Scaup	u	u	
Lesser Scaup	c	c	
Oldsquaw		o	
Black Scoter		o	
Surf Scoter		r	r
White-winged Scoter		o	
Common Goldeneye†	c	c	o
Bufflehead	u	o	
Hooded Merganser†	c	c	c
Common Merganser	c	c	o
Red-breasted Merganser	r	r	
Ruddy Duck	o	o	

VULTURES - HAWKS - FALCONS

Turkey Vulture	o	o	
Osprey	o	o	o
Bald Eagle	o	o	r
Northern Harrier†	c	c	c
Sharp-shinned Hawk	o	o	o
Cooper's Hawk	o	o	o

Northern Goshawk	o	o	o	o
Red-shouldered Hawk†	o	o	o	
Broad-winged Hawk	r	r		
Red-tailed Hawk†	c	c	c	o
Rough-legged Hawk	u	r	o	o
American Kestrel†	c	c	o	
Merlin	r	r	r	
Peregrine Falcon	r	r	r	

GROUSE - TURKEY

Gray Partridge†	u	u	u	u
Ruffed Grouse†	u	u	u	u
Wild Turkey†	u	u	u	u

RAILS - COOT

Virginia Rail†	o	c	c	
Sora†	o	o	o	
Common Moorhen†	c	c	o	
American Coot	o	r	c	

PLOVERS - SANDPIPERS

Black-bellied Plover		o		
Semipalmated Plover	o	o		
Killdeer†	c	o	c	
Greater Yellowlegs	c	c		
Lesser Yellowlegs	o	o		
Solitary Sandpiper	o	o		
Spotted Sandpiper†	o	c	o	
Sanderling		o		
Semipalmated Sandpiper		o		
Least Sandpiper		o		
White-rumped Sandpiper	o	o		
Pectoral Sandpiper		o		
Dunlin		o		
Common Snipe†	c	c	c	
American Woodcock†	c	c	c	

GULLS - TERNS

Bonaparte's Gull	r	r	r	
Ring-billed Gull	c	c	c	o
Herring Gull	u	u	u	
Common Tern	c	o	c	
Black Tern†		c	c	

DOVES - CUCKOOS - OWLS -

SWIFTS - HUMMINGBIRDS

Mourning Dove†	u	o	o	o
Black-billed Cuckoo	u	u	u	
Yellow-billed Cuckoo	u	u	u	
Eastern Screech-Owl†	o	o	o	o
Great Horned Owl†	c	c	c	u
Snowy Owl	r	r	r	
Northern Hawk-Owl	r	r	r	

Barred Owl†	u	u	u	u
Short-eared Owl	o	o	o	
Northern Saw-whet Owl	o	o	o	o
Common Nighthawk	o	o	r	
Whip-poor-will	o	o	o	
Chimney Swift†		o	o	o
Ruby-throated Hummingbird†	o	u	o	
Belted Kingfisher†	u	c	o	

WOODPECKERS - FLYCATCHERS

Red-headed Woodpecker†		r		
Yellow-bellied Sapsucker†	o	c	o	
Downy Woodpecker†	c	c	c	c
Hairy Woodpecker†	c	c	c	c
Northern Flicker†		o	c	o
Pileated Woodpecker†	u	u	u	u
Olive-sided Flycatcher	o	c	o	
Eastern Wood-Pee wee†		o	c	
Alder Flycatcher		c	o	
Least Flycatcher	u	o	o	
Eastern Phoebe†	o	u	o	
Great Crested Flycatcher†	c	c	o	
Eastern Kingbird†		c	c	

LARKS - SWALLOWS - JAYS and CROWS

Horned Lark	o	o	o	o
Purple Martin†	o	o	o	
Tree Swallow†	c	a	o	
Northern Rough-winged Swallow		r		
Bank Swallow†	c	c	o	
Cliff Swallow		o	o	
Barn Swallow†	c	c	o	
Blue Jay†	c	c	c	o
American Crow†	c	c	c	o

TITMICE - NUTHATCHES - WRENS

Black-capped Chickadee†	a	c	c	a
Boreal Chickadee		r	r	
Red-breasted Nuthatch	r	r	r	r
White-breasted Nuthatch†	c	o	c	c
Brown Creeper†	c	u	c	c
House Wren†	o	o	o	
Winter Wren	r	r	r	
Marsh Wren†		o	c	o

KINGLETS - THRUSHES - THRASHERS

Golden-crowned Kinglet	r	r		
Ruby-crowned Kinglet	u	r		r
Blue-gray Gnatcatcher†	u	u		
Eastern Bluebird	r	r	r	
Veery†	c	c	o	
Swainson's Thrush	r	r		

s S F W

— Hermit Thrush†	o	o		
— Wood Thrush†	c	c		
— American Robin†	c	c	c	
— Gray Catbird†	o	c	o	
— Brown Thrasher	o	o	o	

WAXWINGS - SHRIKES - STARLING

— Water Pipit		o		
— Cedar Waxwing†	o	c	o	
— Northern Shrike	u	r	u	u
— Loggerhead Shrike		r		
— European Starling†	a	c	a	c

VIREOS - WOOD WARBLERS

— Solitary Vireo	o	o	o	
— Yellow-throated Vireo	o	c	o	
— Warbling Vireo	o	c	o	
— Philadelphia Vireo	o	o	r	
— Red-eyed Vireo†	c	c	o	
— Tennessee Warbler		r	r	
— Orange-crowned Warbler		r		
— Nashville Warbler	o	o	o	
— Yellow Warbler†	c	c	o	
— Chestnut-sided Warbler	o	o		
— Magnolia Warbler		r	r	
— Cape May Warbler	o	o		
— Black-throated Blue Warbler	o	o	o	
— Yellow-rumped Warbler	o	r		
— Black-throated Green Warbler	r	r	r	
— Blackburnian Warbler	o	o	o	
— Palm Warbler		r		
— Bay-breasted Warbler	o	o	o	
— Blackpoll Warbler		r		
— Black-and-white Warbler	o	o		
— American Redstart†	o	c	o	
— Ovenbird†	o	o		
— Northern Waterthrush†	o	u	r	
— Louisiana Waterthrush	o	u		
— Common Yellowthroat†	c	c	c	
— Canada Warbler	o	o	o	

TANAGERS - SPARROWS

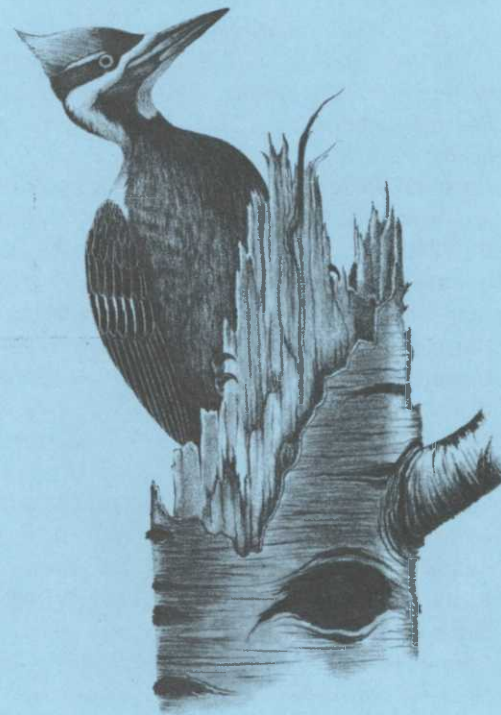
— Scarlet Tanager	r	r	r	
— Northern Cardinal†	u	u	u	c
— Rose-breasted Grosbeak†	c	c	o	
— Indigo Bunting	o	o	o	
— American Tree Sparrow	c	r	o	c
— Chipping Sparrow†	o	c	o	
— Field Sparrow†	o	c	o	
— Vesper Sparrow	o	o	o	
— Savannah Sparrow†	c	c		

s S F W

— Fox Sparrow	o	o	o	
— Song Sparrow†	c	c	o	
— Lincoln's Sparrow		r		
— Swamp Sparrow	o	o	o	
— White-throated Sparrow†	c	c	o	
— White-crowned Sparrow	o	o	o	o
— Dark-eyed Junco	c	r	o	c
— Snow Bunting	o	r	o	c

BLACKBIRDS - FINCHES

— Bobolink†	c	c	o	
— Red-winged Blackbird†	a	a	c	
— Eastern Meadowlark†	c	c	o	
— Rusty Blackbird	u	u	o	
— Common Grackle†	c	c	o	
— Brown-headed Cowbird†	c	o	o	
— Northern Oriole†	c	c		
— Purple Finch	o	o	o	o
— White-winged Crossbill	o	r	o	
— Common Redpoll			r	
— Pine Siskin	r	r	r	
— American Goldfinch†	c	c	c	o
— Evening Grosbeak	c	o	o	c
— House Sparrow†	c	c	c	c



For further information contact:

Refuge Manager
Missisquoi National Wildlife Refuge
RFD #2
Swanton, Vermont 05488
Telephone: (802) 868-4781

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DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE



March 1980

A WALK IN A
WETLAND HABITAT



BLACK CREEK AND MAQUAM CREEK TRAIL



MISSISQUOI
NATIONAL WILDLIFE REFUGE
VERMONT

WELCOME

These trails were constructed by the Mississquoi Youth Conservation Corps, an organization designed to give young people gainful employment while learning and doing something about the environment. They are designed with an emphasis upon the interaction of organisms within an ecosystem. They total approximately 1½ miles in length and take about two hours to walk at a leisurely pace.

Follow the numbered stations and match them with the numbers in your trail guide. Please walk quietly and carefully.

HELPFUL HINTS

1. Walk only on the marked trail. This prevents accidents and keeps environmental damage to a minimum.
2. Please leave nothing behind but footprints.
3. In summer, insect repellent may be desirable.

POINT OF INTEREST NOT ON NATURE TRAIL



GOOSE PEN

In the 1950's a wire enclosure was constructed for the purpose of establishing a resident breeding flock of Canada Geese. Because of predation and poaching, and other factors, the experiment failed. Periodically this pen is brushed out so that it might still be used as a holding area for effected waterfowl if an oil spill should occur on Lake Champlain.

BLACK CREEK TRAIL



The dead tree just ahead of this sign is alive with carpenter ants. Typical signs of carpenter ants are sawdust and little holes in the tree. Carpenter ants and their near relatives are found all over the world and form one of the largest groups of ants. They could do considerable damage if allowed to spread and infest buildings. Carpenter ants speed up the decay process in dead trees, thereby recycling nutrients to the soil.



Behind this sign, you will see an American Elm, which is one of the most widespread and well-known of our American trees. The recent invasion of Dutch Elm disease threatens this tree. The disease occurs as a result of the activity of two different organisms. A beetle first eats a hole in the tree carrying a fungus which is then able to spread, eventually causing the death of the tree.



AMERICAN ELM



The tree surrounded by wire netting is a Swamp White Oak. The netting has been put there to prevent beavers from chewing through the bark. Oaks are important to wildlife because they produce acorns. Acorns are excellent food for wood ducks.



The hole in the ground directly behind this sign is most likely a collapsed muskrat burrow. Muskrats are mostly herbivorous (plant-eating). Their main source of food in this area is bur-reed, arrowhead, wild rice, cut-grass and water lily. As you can imagine, the burrowing habits of the muskrat can reduce the stability of the stream bank.



BEAVER



Notice the beaver damaged tree. If netting were not placed around trees in this area, this type of damage would be widespread. Look up in the tree and notice the lack of growth. When the bark is chewed completely around the tree, the tree becomes "girdled." This means the conducting tissue is cut and no water will reach the leaves, causing death.



The large tree leaning over the water serves as a resting site for birds, particularly ducks. This can be called a "loafing site." This might also be an ideal nesting site for various types of ducks. Black ducks and Mallards would build a nest in a crotch or on a "shelf" of a tree such as this.



Do you see the hole in the beaver lodge? During the winter months refuge personnel have witnessed raccoon hibernating in abandoned lodges such as this one. Lodges also are used as nesting and loafing sites for ducks. This particular lodge must have been built when the water was at a higher level.



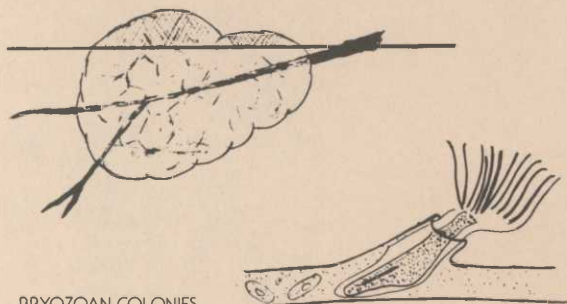
8

At the water's edge, you will observe many different aquatic plants. These serve a variety of functions in their water environment. Plants return oxygen to the water which is used by various micro-animal organisms and fish. Plants also serve as hiding places for fish, ducks, and frogs.



9

Look in the water 10 to 12 feet behind this sign. You will see several large jelly-like masses called bryozoan colonies. Bryozoan colonies are composed of individual animal organisms living permanently massed together. The single units of this colony each have hair-like tentacles called "cilia." The cilia wave back and forth in the water, directing the food particles into the bryozoan's mouth. The foods eaten by these minute organisms are microscopic algae, and single celled animals and plants.



BRYOZOAN COLONIES

MAQUAM CREEK TRAIL



10

Notice the lack of large plants in the area directly behind this sign. What you are seeing is a secondary succession area. Succession is a cyclic replacement of vegetation which eventually results in a mature (climax) community. (Contrast this situation to that of the next station.)



11

Observe the difference in vegetation from the previous station. This vegetation is approaching the climax stage of succession.



12

Directly behind the sign is a "beaver run." Such a run is useful to beavers when they need to transport branches and small logs to the water. Beavers also use these for quick and direct access to the water to escape from danger.



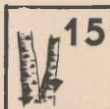
13

The dead tree you see serves as a feeding station for woodpeckers. On the opposite side of this tree, near the top, you will observe large oval holes which are direct evidence of the work of the Pileated Woodpecker. These cavities serve as natural sites for wood duck nests.



14

Do you see a pile of mud directly behind this sign? This pile was constructed by a beaver and is called a "scent mound." Beavers erect these mounds in order to establish a territory for themselves. You will observe numerous scent mounds on both trails.



15

The Birch tree behind this sign has numerous fungal growths protruding from its bark. These are called bracket fungi. Bracket fungi serve as decomposers (organisms which break down the remains and wastes of other organisms into simpler organic substances). The large protruding structure is called a conk.



FERN



16

Ferns are abundant here because of the moist woodland environment. Ferns are a food source for browsing deer and rabbits, although their primary value to wildlife in this area is to conceal smaller animals from predators. As you walk the trail you will be aware of the movement of various animals in the ferns, but you may not be able to see them.



17

This is the largest beaver lodge on the trail. Observe the materials used in its construction. The size of the beaver lodge is directly related to the number of family members it houses.



18

Notice the remnants of saplings (stumps of young trees). These small trees have become part of a beaver lodge.



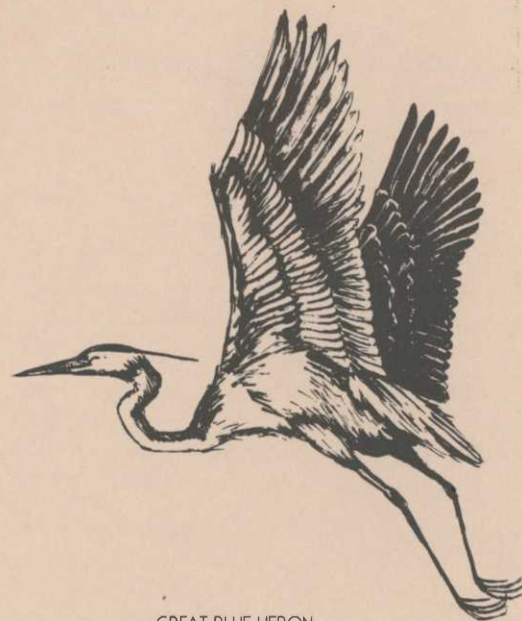
19

In the water behind this sign you should see more evidence that muskrats and beavers live nearby. The path-like areas are routes these animals have recently taken while searching for food.

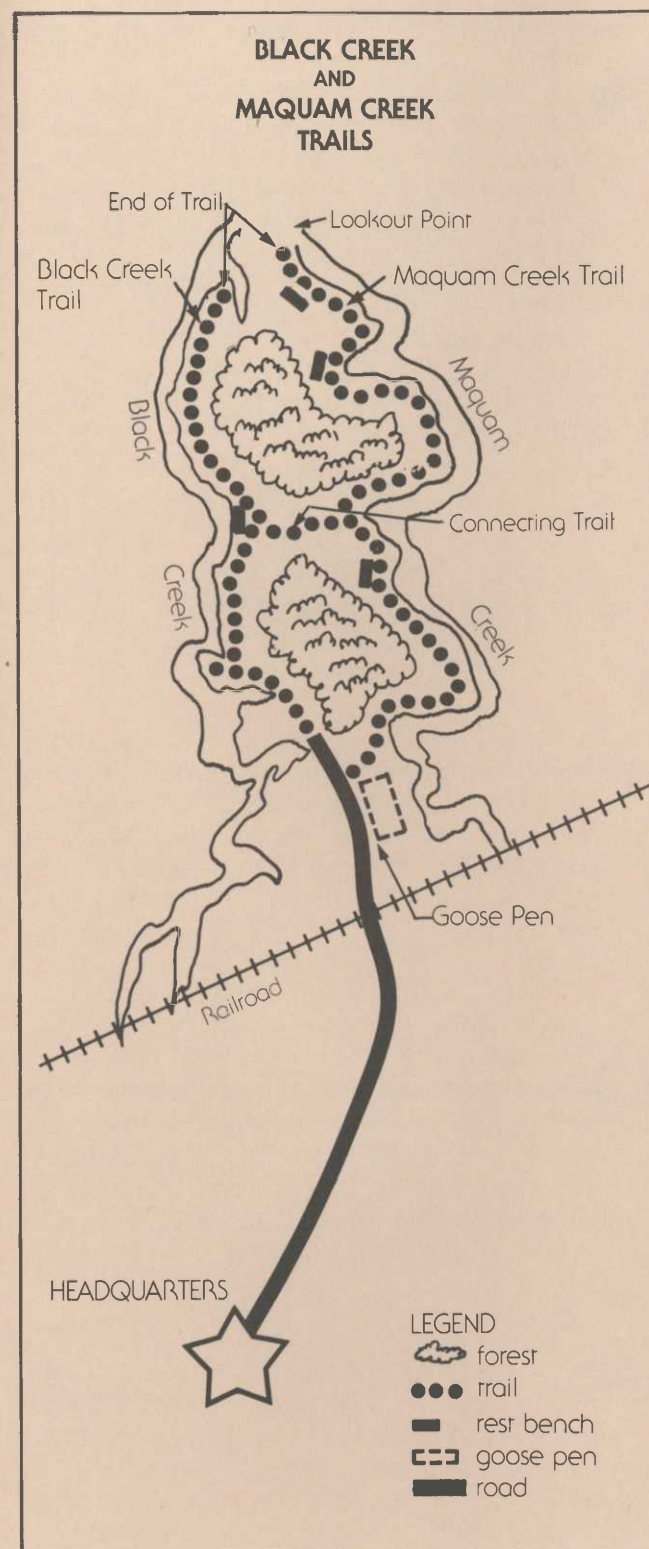


20

As you approached this final point on the Maquam Creek Trail you may have seen some very large birds in flight. These are Great Blue Herons, the second largest of the wading birds that occur in the Northern states. The Missisquoi Refuge contains the largest nesting colony (rookery) of these birds, in Vermont.



GREAT BLUE HERON



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**UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service**



RL53520-1
March 1980

MISSISQUOI NATIONAL WILDLIFE REFUGE



SWANTON, VERMONT

WELCOME

INTRODUCTION

Missisquoi National Wildlife Refuge is approximately 50 miles north of Burlington, in Franklin County, Vermont. It is located on the eastern shore of Lake Champlain near the Canadian border with the headquarters on Highway 78 two miles northwest of Swanton.

This 5,651-acre refuge, occupies much of the Missisquoi River delta and consists of marsh, open water, and wooded swamp. The area is divided by numerous channels and remnants of old water courses, some of which have been closed off by silt deposition. Narrow belts of agricultural land occupy the ridges.

The Missisquoi Refuge and the delta are a water and marsh wonderland with winding channels, woods, and wildlife. The Indian word, "Missisquoi," means an area of "much waterfowl" and "much grass." This describes the delta very well, as many ducks and geese are attracted by richly vegetated shorelines and marshes that produce an abundance of choice foods.

PURPOSE

Missisquoi National Wildlife Refuge is a link in the chain of refuges extending from the northern migratory bird breeding grounds to the southern wintering areas. The refuge was established in 1942 to produce waterfowl and provide feeding and resting areas for migrating waterfowl in the northern Lake Champlain section of the Atlantic Flyway. With increasing losses of wildlife habitat as a result of human population growth and industrial and residential expansion, the refuge has become increasingly



important to the preservation of wildlife resources. While secondary to wildlife benefits, refuge use for wildlife oriented recreation; interpretation; and environmental education is encouraged.

A 1½ mile wildlife interpretive trail, partially boardwalk, is located behind the headquarters building. The trail is open from daylight to dark the entire year.

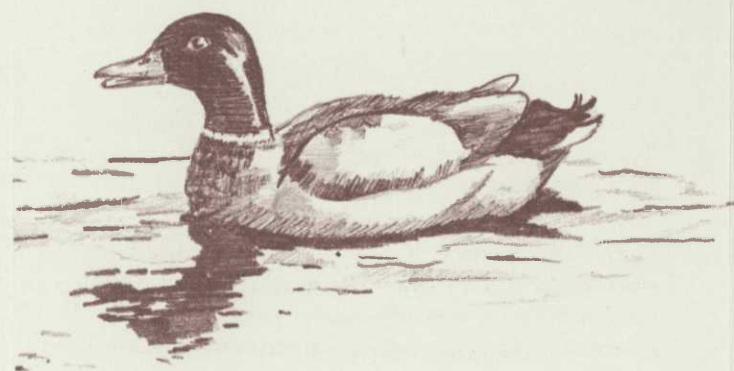
HISTORY

Silt and sand carried down the river during the spring floods created the delta now covered with marshes and timbered areas. Channels were cut in the sand bars formed at the river's mouths, thus extending the

river into the lake. As water velocity dropped, the lighter particles of fine silt were deposited farthest back in the slack-water areas on each side of the main channel. This light material was rich in plant nutrients, and plant life blossomed where there had once been nothing but sand. Quite often a section of the lake was enclosed by the higher deposits along the sides of main channels, forming marshes protected from the wind and waves. These are the marshes which produced aquatic plants most favored by waterfowl and which became an attraction for birds migrating through Lake Champlain. Due to natural succession, a good share of this duck habitat gradually changed to brush and trees, the marsh area dwindled and fewer ducks stopped in migration.

MANAGEMENT

The management of this refuge is aimed primarily at enhancing duck habitat by encouraging wet marsh conditions on some 1,800 acres of flooded plains. Safe sites for nesting and resting areas are also maintained.



BIRDS

Ducks that migrate through this portion of the flyway come primarily from the numerous lakes and marshes in the provinces of Quebec and Ontario, from the St. Lawrence River Valley, and from the Hudson Bay area. During the peak of the fall migration there may be as many as 22,000 ducks present on the refuge at one time. Waterfowl are also numerous on adjacent private marshes and in Lake Champlain on Missisquoi and Maquam Bays. Canada geese can be found using refuge lands in April and May.

The largest concentrations of waterfowl occur during April, September and October. Black ducks, mallards, wood ducks, and common goldeneyes are the most numerous nesting waterfowl, but there are also a few blue-winged teal, and hooded mergansers.

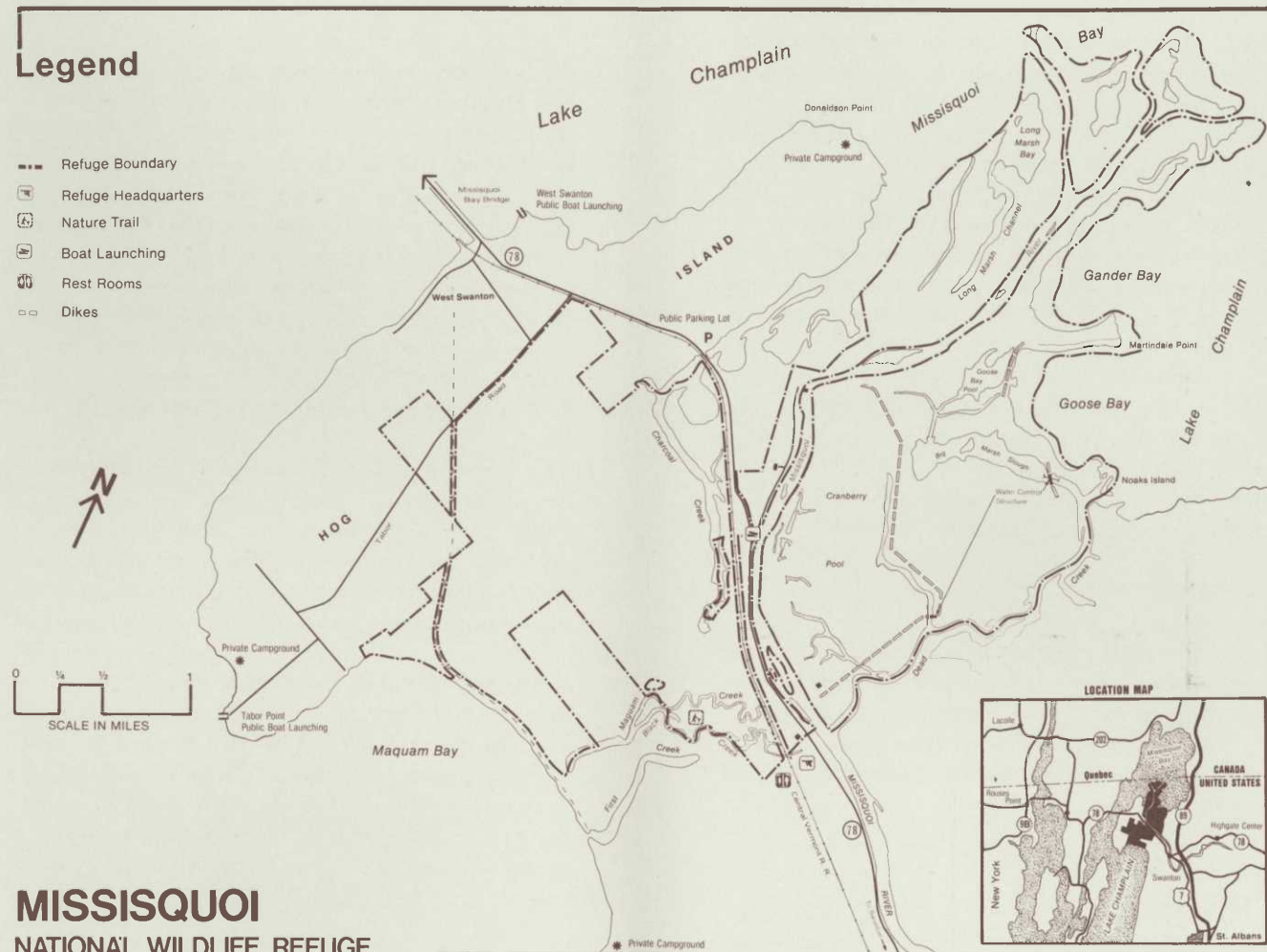
A variety of other birds are also present during the spring, summer, and fall. Nesters include the great blue heron, American bittern common gallinule and many species of songbirds. Marsh hawks, red-tailed hawks, great horned owls, barred owls, ospreys, and an occasional bald eagle also may be seen.

OTHER WILDLIFE

Other forms of wildlife also inhabit the refuge. Deer are seen from time to time, especially in spring. Red fox, beaver, red and gray squirrels, chipmunks, and raccoons may be observed on occasion as well as mink and otter. Muskrats are seen frequently in water areas.

Legend

- Refuge Boundary
- ☒ Refuge Headquarters
- 🚶 Nature Trail
- 🚤 Boat Launching
- 🚽 Rest Rooms
- Dikes



MISSISQUOI

NATIONAL WILDLIFE REFUGE

FISH

Warm-water fish are numerous in the waters surrounding the refuge. There is fishing for walleyed pike, bass, northern pike, and bullheads. Fishing is permitted on the refuge only along the banks of the Missisquoi River. Contact the Refuge Manager for current regulations.

HUNTING

Hunting is permitted in specified locations. Contact the Refuge Manager for current regulations.

SEEING THE REFUGE

Public use areas of the refuge are open during daylight hours for the purpose of nature study, wildlife observation, photography, hiking and general sightseeing. Visitors with more specified needs or special interests should apply at refuge headquarters for special use permits and further information.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.